

Wind Tunnel Operations Division and Support Contractor

Safety Manual

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List of Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ARC	Ames Research Center
BAAQMD	Bay Area Air Quality Management District
BEAP	Building Emergency Action Plan
CCR	Title 22 California Code of Regulations
CEPP	Chemical Emergency Preparedness Program
CFR	Title 40 Code of Federal Regulations
cm	centimeter
DHHS	Department of Health and Human Services
EPA	Environmental Protection Agency
FSM	Facility Service Manager
ft	foot or feet
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV,	Human Immunodeficiency Virus
hr	hour(s)
i.e.	that is
in	inch or inches
lbs	pounds
m	meter or meters
mR	milliroentgen
MSDS	Material Safety Data Sheet
NASA	National Aeronautics and Space Administration
NFPA	National Fire Protection Association
NIOSH	The National Institutes for Occupational Safety and Health
NRC	Nuclear Regulatory Commission
OSHA	Federal Occupational Safety and Health Administration
PPE,	Personal Protective Equipment
RCRA	Resource Conservation Recovery Act
REL	Recommended Exposure Limit
RSO	Ames Radiation Safety Officer
SARA	Superfund Amendments and Reauthorization Act

List of Acronyms and Abbreviations

SEMA	Safety, Environmental and Mission Assurance
SPA	Safety Plan of Action
SPC	Single Point of Contact
VOC	Volatile Organic Compound

1. Introduction

1.1. Description

Purpose	All Wind Tunnel Operations Division personnel are responsible for following the requirements contained in the Ames Health and Safety Manual, AHB 1700.1. This manual was developed in accordance with that manual and Occupational Safety and Health Administration (OSHA) regulations. Each chapter of this safety manual describes specific Division requirements and guidelines that supplement and help ensure uniform compliance with established Ames and OSHA safety requirements.
Scope	<p>This manual applies to Division civil servant and support contractor personnel, subcontractors, temporary workers, and visitors under the authority of the Wind Tunnel Operations Division.</p> <p>For safety topics not described within this manual, refer to the on-line Ames Health and Safety Manual, AHB 1700.1, available on the Ames Research Center Intranet at http://arcweb.arc.nasa.gov/, or contact the Division Safety Office for assistance.</p>

1.2. References

Documents	<p>This manual complies with, or refers to additional information provided in the current revisions of the following Ames and Division documents:</p> <ul style="list-style-type: none">• Ames Environmental Procedures and Guidelines, APG 8800.3• Ames Health and Safety Manual, AHB 1700.1• Ames Safety Accountability Program, Bloodborne Pathogens• Building Emergency Action Plan (BEAP), all Wind Tunnel Operations Division Buildings• The Division Environmental Compliance Plan, A327-9291-XS1• The Hazard Communication Program, Wind Tunnel Operations Division• Wind Tunnel Operations Division Document Control Procedures, A027-9991-XR1
Forms	<p>The following forms are referred to in this manual and are available on the Division Documents Web site at http://pubsgroup.arc.nasa.gov/.</p> <ul style="list-style-type: none">• Hazardous Material Pickup Request Form, Form A• Hazardous Materials Safe Work Procedure, FO8• New Chemical Purchase Approval Form, FO9

1. Introduction

- Purchase Request/Purchase Order—Special Approvers Routing Information
- Purchase Requisition Form
- Safe Plan of Action
- Weekly Inspection—Hazardous Materials and Waste Storage, FO4

End of Chapter

2. Hazard Communication and Handling Hazardous Materials

2.1. Description

Purpose The purpose of this chapter is to reduce injury and illness caused by exposure to hazardous materials by describing requirements for communicating information about hazardous materials, and for handling them. It's purpose is also to comply with and fulfill the Federal Occupational Safety and Health Administration (OSHA) and NASA hazard communication requirements.

For other regulations and requirements regarding hazardous materials, refer to the chapter on [Environmental Compliance](#). For more detailed information, refer to the Division Hazard Communication Program and regulatory documents available in the Division Safety Office.

Scope This chapter applies to anyone under the authority of the Wind Tunnel Operations Division, including civil servant, support contractor, and temporary personnel whose activities put them at risk for hazardous materials related injuries or illnesses.

Division Safety Office approval is required for any deviations from the requirements of this chapter.

2.2. Rights and Responsibilities

Employee Rights Employee rights include the following:

- To receive information regarding hazardous materials in work areas.
- To have access to the Hazard Communication Program.
- To have access to the Hazardous Materials Inventory.
- To have access to a Material Safety Data Sheet (MSDS) for each hazardous material in work areas.
- To allow a physician or collective bargaining agent to access information regarding hazardous materials in the employee's workplace.
- To refuse to perform work without repercussion, such as being discharged or discriminated against, when information about hazardous materials is unavailable, or when conditions or practices associated with hazardous materials pose an imminent danger of injury or harm to personnel, facilities, or equipment.

Managers

Managers' responsibilities include the following:

- To ensure that the requirements described in this chapter are met.
 - To ensure that hazardous materials in areas under their control are used safely.
 - To provide employees with required hazard communication training and resources.
-

Supervisors

Supervisors' responsibilities include the following:

- To ensure safe use and storage of hazardous materials.
 - To ensure that personnel successfully complete hazard communication training prior to working with hazardous chemicals.
 - To ensure that personnel receive job-specific instruction prior to working with hazardous chemicals.
 - To ensure that personnel receive training regarding the limitations, use, maintenance, storage, and disposal of personal protective equipment (PPE), and that PPE is freely available and used by personnel whenever required.
 - To ensure that an up-to-date MSDS is available to all shifts in each work area for each chemical used in that area.
 - To ensure that all chemical containers and piping are properly labeled to identify their contents and hazardous properties.
 - To ensure that the most recent Hazardous Materials Inventory is available to personnel, and that it's updated annually .
 - To submit hazardous materials purchase requisitions to the Division Safety Office for authorization.
 - To notify the Division Safety Office before new hazardous materials are introduced into the work area.
 - To notify the Division Safety Office whenever a hazardous material is no longer used or stored in the work area.
 - To complete the Hazardous Materials Non-Routine Task Form, FO8, for each non-routine task that requires using hazardous materials, and review it with personnel before they perform the task.
 - To notify all personnel in the area who may be affected whenever there is potential for exposure to hazardous materials.
-

Employees

Employees' responsibilities include the following:

- To adhere to the requirements described in this chapter.
- To successfully complete hazard communication training before working with hazardous materials.
- To understand chemical hazards and their controls.

2. Hazard Communication and Handling Hazardous Materials

- To complete training and adhere to requirements regarding the limitations, use, maintenance, storage, and disposal of PPE.
- To read the MSDS and container label for each hazardous material they may be exposed to in their work areas, and to request clarification if needed.
- To promptly notify management about missing or defaced labels on hazardous materials containers.
- To clearly identify and describe the hazardous material and circumstances to emergency personnel in the event of personnel exposure or a spill.

Division Safety Office

The Division Safety Office's responsibilities include the following:

- To ensure compliance with OSHA and NASA hazard communication requirements.
 - To annually review the content of this chapter, and to direct any necessary changes and updates.
 - To annually review the Hazard Communication Program, and to direct any necessary changes and updates.
 - To maintain employee hazard communication training records in a database.
 - To assist supervisors with tracking employee hazard communication training records.
 - To maintain a central MSDS file for all hazardous materials used or stored in all work areas.
 - To provide labels for hazardous materials containers as needed.
 - To perform work area audits to verify compliance with the requirements of this chapter.
 - To review all purchase requisitions for hazardous materials, including each relevant MSDS, before authorizing hazardous materials purchases.
 - To review proposed new chemicals and processes before they're introduced into the workplace.
 - To submit an updated Hazardous Materials Inventory to the Ames Research Center (ARC) on an annual basis, or when any major change takes place.
-

Project
Managers for
Subcontractor
Activities

Project managers for subcontractor activities have responsibilities that include the following:

- To notify the Division Safety Office of any scheduled subcontractor work involving hazardous materials.
 - To ensure that the subcontractor performs all work activities in compliance with this chapter.
 - To notify all personnel in the area who may be affected whenever there is potential for exposure to hazardous materials.
 - To ensure that all shifts have access to an up-to-date MSDS for each chemical used in their work areas.
 - To ensure that all shifts have access to an up-to-date Hazardous Materials Inventory of the chemicals used in their work areas.
-

Subcontractors

Subcontractor's responsibilities include the following:

- To obtain approval from the project manager and the Division Safety Office prior to using or storing hazardous materials in any work area.
 - To provide the project manager with records demonstrating that subcontractor personnel receive hazard communication training that complies with OSHA, NASA, and the Division hazard communication requirements.
 - To provide subcontractor personnel with job-specific instruction prior to working with hazardous chemicals.
 - To ensure that subcontractor personnel receive training regarding the limitations, use, maintenance, storage, and disposal of PPE.
 - To provide subcontractor personnel with PPE and safety devices unless the contract stipulates otherwise.
 - To ensure that an up-to-date MSDS is available in each work area for each chemical used in that area.
 - To notify the project manager, the Division Safety Office, and any affected groups or individuals whenever there is a potential for exposure to hazardous materials used or stored by subcontractor personnel.
 - To remove subcontractor-owned hazardous materials from the site when the contracted period of work ends, unless the contract stipulates otherwise.
 - To clearly identify and describe the hazardous material and circumstances to emergency personnel in the event of a hazardous materials spill or other hazardous materials exposure.
-

Purchasing	<p>The Purchasing Department's responsibilities include the following:</p> <ul style="list-style-type: none">• To verify that purchase requisition forms for hazardous materials have an appropriate Division Safety Office approval signature.• To verify that a New Chemical Purchase Approval form, FO9, is submitted with each purchase requisition for a new chemical.• To request that the vendor supply a current MSDS for each chemical purchased. <hr/>
Shipping and Receiving	<p>The Shipping and Receiving Department's responsibilities include the following:</p> <ul style="list-style-type: none">• To refuse delivery of hazardous materials containers without proper labels.• To only accept containers that are in good condition.• To ensure that any required MSDS is included with the shipment, and to distribute copies to the hazardous material owner and the Division Safety Office. <hr/>

2.3. General Requirements

Hazard Identification and Evaluation	<p>Personnel who work where hazardous materials are used or stored shall identify and evaluate hazards in the work area by taking precautions that include the following:</p> <ul style="list-style-type: none">• Reading the labels on all containers used or stored in the work area.• Reading the MSDS for each hazardous material used in the work area.• Remaining alert for signs or symptoms of overexposure described in the MSDS for each hazardous material in the work area.• Being aware of workplace conditions, such as unusual odors or tastes, spilled liquids, hissing sounds, opened containers, or damaged or deformed containers.• Discussing and documenting pre-task planning, such as a Safety Plan of Action (SPA). <p>Other Division methods for identifying and evaluating hazardous materials in the workplace may include the following:</p> <ul style="list-style-type: none">• Completing a Hazardous Materials Non-Routine Task Form, FO8, and providing training accordingly.• Safety Office review and approval prior to hazardous materials purchases.• Periodic MSDS review by the Safety Office.• Periodic industrial hygiene sampling and analysis, such as air or wipe samples.
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2. Hazard Communication and Handling Hazardous Materials

- Medical surveillance conducted on users while hazardous materials are in use.
- Reviewing published information prepared by OSHA, The National Institutes for Occupational Safety and Health (NIOSH), and the American Conference of Governmental Industrial Hygienists (ACGIH).
- Identifying trends by periodically reviewing accident and injury data.
- Evaluating employee suggestions and complaints.

If a new risk is identified, management shall be notified. Work shall cease until all hazards and controls are defined and satisfactorily addressed.

Hazard Controls

Various controls may be used for reducing or eliminating risks associated with using and storing hazardous materials. This section identifies preferred controls, however, it may sometimes be necessary to use temporary controls for intermittent conditions, or while permanent solutions are being designed, funded, or installed. For more detailed information regarding hazard controls, refer to the Hazard Communication Program.

The following hazard controls are listed in order of preference:

- Designing or substituting lower risk materials to use in place of more hazardous materials.
 - Implementing engineering measures that reduce risk, such as local exhaust ventilation, chemical isolation, guards, enclosures, interlocks, and monitoring alarms.
 - Developing operations and maintenance procedures that reduce risk.
 - Using personal protective equipment that protects individuals from exposure to hazardous materials.
 - Implementing administrative measures, such as a work rotation that reduces employee exposure to hazardous materials.
-

Labeling

Primary and secondary labels for hazardous materials containers are required. Some secondary labels are available from the Division Safety Office. Labels for other materials and containers, such as piping, tanks, and waste containers, are required as well. For more details, refer to the Hazard Communication Program.

Primary Labels

A primary label is the label on the original container provided by the manufacturer. It must provide the following information:

- The manufacturer's name and address.
- The identity of the hazardous material.
- An appropriate hazard warning.

Secondary Labels

A secondary label is used on a separate container when a hazardous material is transferred to it from the original container. It must provide the following information:

- The identity of the hazardous material.
- An appropriate hazard warning.

Other Labels

Other labeling requirements include the following:

- Containers of non-hazardous material, such as water, shall be labeled to eliminate confusion or misuse.
- Piping shall be labeled to identify its contents and associated hazards. Other methods of conveying this information may be established.
- Hazardous waste containers shall be labeled with hazardous waste labels and dated in accordance with the Ames Environmental Procedures and Guidelines, APG 8800.3, and the Division Environmental Compliance Plan, A327-9291-XS1.
- Labels shall not be removed or defaced.
- Damaged labels shall be promptly replaced.
- Labels must be legible, in English, and displayed prominently on the exterior of the container.
- Chemical storage areas, cabinets, and tanks shall be labeled in accordance with the National Fire Protection Association (NFPA) labeling system. Refer to the Hazard Communication Program for more details.

The Material Safety Data Sheet (MSDS)

Manufacturers of hazardous materials are required by law to evaluate the hazards associated with their products, and to provide users with relevant safety, health, and environmental information.

An MSDS is a document that provides safety, health, and environmental information about a hazardous material. Vendors generally include an MSDS with each shipment of hazardous material, and generally supply copies upon request. For more details about the information provided on an MSDS, refer to the Hazard Communication Program.

The following are MSDS requirements:

- Each area shall have a clearly labeled, easily accessible binder that contains an MSDS for each hazardous material used or stored in that area.
- Supervisors shall maintain the area-specific MSDS binders to ensure that they are complete and up-to-date.

2. Hazard Communication and Handling Hazardous Materials

- Supervisors shall ensure that employees are aware of the MSDS binders.
 - The Division Safety Office shall maintain an MSDS master file for each hazardous material identified on the Hazardous Materials Inventory.
 - The Division Safety Office may assist in obtaining an MSDS for a hazardous material.
-

The Hazardous Materials Inventory

The Hazardous Materials Inventory shall be available from the Division Safety Office, in the Building Emergency Action Plan (BEAP) located in the lobby of each building or available from the facilities service manager, and in each area-specific MSDS binder.

Supervisors shall perform the following:

- Maintain updated area-specific hazardous materials inventories.
 - Notify the Division Safety Office or the hazardous materials manager of any major changes in the their Hazardous Materials Inventory. Major changes include the following:
 - Disposing of hazardous materials that will not be replaced.
 - Adding new hazardous materials.
 - Significantly reducing or increasing the quantity of hazardous materials already on the inventory.
-

Storing and Handling Hazardous Materials

Hazardous materials in any form shall be stored, handled and used in a safe manner as described in this chapter, in the chapter on Environmental Compliance, in the Hazard Communication Program, and in training for hazardous communication and handling hazardous materials.

Requirements for storing and handling hazardous materials include the following:

- Personnel shall use personal protective equipment (PPE) as required.
- Incompatible hazardous materials shall be stored in separate storage areas to minimize risk of fire, explosion, or toxic gas release.
- Hazardous materials containers shall be tightly closed.
- Hazardous materials containers shall be properly labeled.
- Secondary containment shall be used for storing liquid hazardous materials.
- All hazardous conditions, such as leaks, spills, and reactivity, shall be promptly corrected.

Hazardous materials that are no longer in use shall be removed from storage, and disposed of or recycled through the Ames hazardous waste contractor.

Subcontractors are required to remove all their hazardous materials from the work site upon completion of the job, unless the contract stipulates otherwise.

**Hazardous
Materials
Storage Area
Inspections**

Weekly hazardous materials storage area inspections are mandated by the Ames Health and Safety Manual, AHB 1700.1; the Division Environmental Compliance Plan; and county, state, and federal regulations. Each department that uses or stores hazardous materials is responsible for performing and documenting weekly inspections of all their hazardous materials storage areas.

Hazardous materials storage areas include the following:

- Above ground storage tanks.
- Chemical storage lockers or cabinets.
- Secondary containment systems.
- Hazardous waste storage areas.

Contractor-Conducted Inspections

The Maximo maintenance database generates preventative maintenance work orders that are issued to those who conduct hazardous materials storage area inspections for maintenance operations. The inspection process is the following:

- The Weekly Inspection—Hazardous Materials and Waste Storage form, FO4, shall be completed and submitted to the supervisor each week.
- The supervisor updates the Maximo database by entering an inspection completion date.
- The supervisor forwards a copy of the completed inspection form to the Division Safety Office.
- The Division Safety Office retains completed inspection forms for 3 years.

Civil Servant-Conducted Inspections

The Division hazardous materials manager tracks hazardous materials storage area inspections conducted by civil servants. The inspection process is the following:

- The Weekly Inspection—Hazardous Materials and Waste Storage form, FO4, shall be completed and submitted to the supervisor each week.
 - The hazmat manager performs weekly storage inspections, and retains completed inspection forms for 3 years.
-

Hazardous
Material
Donation or
Disposal

Hazardous materials requirements apply to all hazardous materials, including hazardous waste. For more information about hazardous waste, refer to the Labeling section and to the Storing and Handling Hazardous Materials section. Also refer to the chapter on Environmental Compliance, as well as the Environmental Compliance Plan. For questions regarding hazardous waste, contact the Division Safety Office.

The following applies to empty containers:

- Hazardous materials containers that are empty are hazardous waste.
- It is prohibited to use empty hazardous materials containers for collecting any other material or waste.

To donate or dispose of hazardous materials that are no longer needed, use the Hazardous Material Pickup Request Form, Form A, and submit the completed form to the Ames hazardous waste contractor.

Unless the contract stipulates otherwise, subcontractors who generate hazardous waste on-site may dispose of it by contacting the Ames hazardous waste contractor.

Emergency
Response for
Spills, Leaks,
and Releases

This section describes emergency and communication requirements for handling hazardous materials spills, leaks, and releases. For more information about hazardous materials spills, leaks, and releases, refer to the Environmental Compliance chapter, the Hazard Communication Program, and the Building Emergency Action Plan (BEAP).

In general, emergency response steps following a hazardous materials spill, leak, or release include the following in order of preference:

- Dial 9-1-1 if health or the environment is threatened. From a cellular phone, dial (650) 604-5555.
- Notify the area supervisor or manager.
- Notify the Division Safety Office, which in turn notifies the Ames environmental staff to ensure reporting to the appropriate authorities.
- Evacuate and deny entry to the affected area.
- Control the spill, leak, or release, but only if it can be safely controlled.
- Contain the spill, leak, or release, but only if it can be safely contained.
- Relay appropriate information and identify the hazardous material(s) to emergency response personnel.

There are three different levels of hazardous materials spills or releases depending on severity. These levels are reportable/recordable spills, non-reportable/recordable spills, and non-reportable/non-recordable spills. These spills are described below:

Level 1: Reportable/Recordable Spills

A reportable/recordable spill is hazardous to health or the environment. A spill is reportable/recordable when a hazardous material is no longer in a primary container, and one or more of the following occurs:

- It reaches the environment.
- It enters the sewer or storm drain.
- It causes real or potential injury to persons or to the environment.
- It contacts asphalt, particularly if the hazardous material is a solvent.
- It requires more than 8 hours to clean up, even if it is contained by secondary containment and doesn't affect the environment.
- It escapes secondary containment.

If there is a reportable/recordable spill, do the following:

- Call 9-1-1. The 9-1-1 dispatch notifies the ARC authorities, who in turn evaluate the situation and notify the appropriate emergency and regulatory agencies.
- Notify the area supervisor or manager.
- Notify the Division Safety Office, which in turn notifies the Ames environmental staff to ensure reporting to the appropriate authorities.
- Obtain Safety Office assistance in recording the spill on the Recordable Spill Log in the BEAP, located in the building lobby, or in the facilities service manager's possession.

Level 2: Non-Reportable/Recordable Spills

A non-reportable/recordable spill is minor and poses no hazard to health or the environment. A spill is non-reportable/recordable when a hazardous material is no longer in a primary container, and all the following are true:

- None of the material reaches the environment.
- None of the material enters the sewer or storm drain.
- It causes no real or potential injury to persons or to the environment.
- None of the material contacts asphalt.
- It requires less than 8 hours to clean up.
- It remains contained within secondary containment.

Non-reportable/recordable spills may be cleaned by trained individuals. The following are ARC guidelines for cleaning a non-reportable spill:

- The individual cleaning the spill must be competent and specifically trained to clean the hazardous material.
- Spill clean-up equipment and PPE must be available.

2. Hazard Communication and Handling Hazardous Materials

- The spill clean-up takes less than 2 hours. (If the spill clean-up approaches this 2-hour limit, the Division Safety Office shall consult with the ARC Office of Safety and Mission Assurance.)
- The individual cleaning the spill must feel safe.
- Call 9-1-1 if in doubt.

A non-reportable/recordable spill does not need to be reported by calling 9-1-1, but unless the spill meets the criteria for non-reportable/non-recordable spills, it must be recorded. If the spill is recordable, do the following:

- Notify the Division Safety Office. The Division Safety Office maintains a file of all recordable spills.
- Obtain Safety Office assistance in recording the spill on the Recordable Spill Log in the BEAP, located in the building lobby, or in the facilities service manager's possession.

Level 3: Non-Reportable/Non-Recordable Spills

A non-reportable/non-recordable spill is less than one ounce and poses no hazard to health or the environment. There is no need to notify the Division Safety Office or record the spill in the Recordable Spill Log if it is non-recordable, however, the same ARC guidelines for cleaning a non-reportable/recordable spill apply to non-recordable spills.

A non-recordable spill is defined by the following:

- The spill is non-reportable.
- The spilled material weighs less than 1 oz.
- The spill can be cleaned up within 15 minutes.
- The primary container is not deteriorated.
- The material user is trained and equipped to clean up the spill.

Emergency Response for Personal Contamination

Direct, indirect, and suspected personal hazardous material contamination must to be treated immediately. For assistance, call 9-1-1. Provide emergency response personnel the relevant MSDS and all information regarding the contamination.

Standard immediate treatment includes the following:

- Flushing the affected area with water for a minimum of 15 minutes.
- Removing contaminated clothing as soon as possible.

Depending on the level of injury, notify the following:

- The Duty Office at 9-1-1 dispatch.
- The Ames Health Unit at extension 4-5287.

- The area supervisor or manager.
- The Division Safety Office.

Purchasing Hazardous Materials

Division Safety Office approval is required to purchase hazardous materials in order to ensure proper training and documentation, safe storage, handling, and disposal of hazardous materials, and to avoid OSHA, EPA, or local authority citations and penalties.

Before approving purchase requisitions for hazardous materials that are new to the work site, the Division Safety Office must review the new hazardous materials. The review shall determine if health and safety parameters are reasonable.

If you have questions about ordering a hazardous material, or if you're not sure a hazardous material has been approved, contact the Division Safety Office for assistance.

The step-action tables in this section describe the procedure for ordering hazardous materials through the Purchasing Department, including Preliminary Steps, Obtaining Approval for New Hazardous Materials, Submitting a Purchase Requisition, and Receiving Hazardous Materials.

Preliminary Steps

Follow these steps before completing any purchase requisition forms:

Step	Action
1	Determine if the hazardous material is already listed on the area-specific Hazardous Materials Inventory .
2	Determine if the MSDS for the hazardous material is in the work area binder.
3	If the material is listed on the inventory, but there is no MSDS, or if there is an MSDS, but the material is not listed on the inventory, consult with the Division Safety Office.
4	If the hazardous material is not listed on the area-specific Hazardous Materials Inventory, and if there is no MSDS for it in the work area binder, proceed to the steps for obtaining approval for new hazardous materials.
5	If the hazardous material is already listed on the Hazardous Materials Inventory, and the MSDS is in the work area binder, proceed to the steps for submitting the purchase requisition.

Obtaining Approval for New Hazardous Materials

Follow these steps for obtaining approval for new hazardous materials:

Step	Action
6	Contact the distributor or manufacturer, and request a copy of the MSDS for the hazardous material.
7	Complete page 1 of the New Chemical Purchase Approval Form, FO9.
8	On page 2 of the Purchase Requisition, SB9, check the box for Caustic, corrosive, toxic or flammable materials/gasses (including paints, coatings, chlorofluorocarbons or Halons), and complete the form.
9	Submit both forms and the MSDS to the Division Safety Office.
10	After obtaining approval signatures from the Division Safety Office on both forms, proceed to the steps for submitting a purchase requisition to the Purchasing Department.

Submitting a Purchase Requisition to the Purchasing Department

Follow these steps for submitting a purchase requisition to the Purchasing Department:

Step	Action
11	Complete a Purchase Requisition, SB9, if you have not already done so.
12	Obtain all approval signatures on the Purchase Requisition Form, including a Division Safety Office signature.
13	Submit both pages of the Purchase Requisition Form to the Purchasing Department and, if ordering a new hazardous material, also submit the approved New Chemical Purchase Approval Form.
14	If ordering a new hazardous material, put copies of the signed New Chemical Purchase Approval Form and the respective MSDS in the area-specific binder.

Receiving Hazardous Materials

Follow these steps upon receiving hazardous material:

Step	Action
15	Shipping and Receiving verifies that containers are properly labeled and in good condition. Shipments of damaged containers or improperly labeled hazardous materials shall not be accepted.
16	Shipping and Receiving ensures that there is a corresponding MSDS for the shipment, forwards a copy to the Division Safety Office, and ensures that the owner receives a copy.
17	Upon receiving hazardous materials from Shipping and Receiving, inspect and verify that the containers are properly labeled, in good condition, and that there is a corresponding MSDS.
18	If any requirements identified in the previous step are not met, notify the supervisor and the Division Safety Office immediately and await further instructions before using the hazardous materials.
19	Add the new quantity to the work area Hazardous Materials Inventory.
20	Notify the Division Safety Office to add the new quantity to the master Hazardous Materials Inventory.

Bankcard Purchases of Hazardous Materials

Hazardous materials purchased by bankcard must meet all the requirements for on-site hazardous materials as described in this chapter, including the requirements for an MSDS, inventories, and labeling.

Bankcard holders may only purchase safety-restricted hazardous materials with a written pre-authorization agreement from Safety, Environmental and Mission Assurance (SEMA). The SEMA web site is located at <http://dq.arc.nasa.gov>.

Safety-restricted hazardous materials include the following:

- Products identified as health and safety hazards, such as caustic, corrosive, toxic, flammable, or reactive products.
- Products that may pollute the air, such as regulated gases or volatile solvents, including chlorofluorocarbons or halons, and paints or coatings with volatile organic compounds (VOCs).

2.4. Training Requirements

Hazard Communication Training

Personnel who use or may be exposed to hazardous materials in the work area, whether on a routine basis or as the result of an emergency, shall receive hazard communication training.

The Division Safety Office provides assistance in registering for initial hazard communication training which includes the following:

- Review of the scope, purpose, and requirements of this chapter.
 - The Employee Right-to-Know law and other employee rights.
 - The potential physical and health effects from exposure to the hazardous materials in the work area.
 - Explanation of the content in a MSDS.
 - Using controls for reducing or eliminating risks associated with using and storing hazardous materials, including using PPE.
 - Labeling requirements for hazardous materials and waste.
 - Recognizing hazards, including using methods and observation techniques for determining the presence or release of hazardous materials.
 - Emergency procedures, including how to respond to a chemical spill, leak, or other exposure to hazardous materials.
-

Task-Specific Training

Supervisors provide employees with task-specific training in hazardous communication and hazardous materials handling.

Task-specific training is more detailed and provides information on the tasks the employee shall perform, including the engineering work practices and the required PPE the employee shall use. This training should be incorporated into written operating and maintenance procedures for both routine and non-routine tasks.

Update Training

Personnel shall receive update training on hazard communication whenever the following occurs:

- A new hazardous material or process is introduced at the work site.
 - There is new or updated information concerning materials used at the work site.
 - Hazardous materials handling requirements or work practices change.
 - Refresher training recommended by ARC.
-

Training for Non-Routine Tasks

Whenever employees are to perform non-routine tasks using or working near hazardous materials, their managers or supervisors shall complete the Hazardous Materials Non-Routine Task Form, FO8, and use the completed form for training the employees.

Examples of non-routine tasks include the following:

- Using a site-approved chemical in a new operation.
- Using a site-approved chemical with different equipment.
- Applying a site-approved chemical under different parameters.

The Division Safety Office shall provide assistance in completing the Hazardous Materials Non-Routine Task Form, and in determining what safeguards and training are required for performing a non-routine task. For more information about completing the Hazardous Materials Non-Routine Task Form, refer to the Hazard Communication Program.

Completed Hazardous Materials Non-Routine Task Forms shall include the following:

- A task description.
- Identification of the hazardous materials required to perform the task.
- The required protective and safety measures for performing the task.
- A description of the measures management is taking to reduce the hazards at the work site.

Managers or supervisors shall:

- Use completed Hazardous Materials Non-Routine Task Forms to review with employees the hazards they may be exposed to while performing non-routine tasks.
 - Ensure that employees receive appropriate training before beginning non-routine work.
 - Maintain file copies of all completed Hazardous Materials Non-Routine Task Forms.
-

2.5. Record-Keeping Requirements

Training Records

The Division Safety Office maintains formal Hazard Communication training and attendance records in the TNC database. The TNC database contains all Division safety training records, and is available to managers and supervisors to assist them in complying with training requirements.

The ARC Safety, Environmental and Mission Assurance Office also provides the past three years of site safety and hazard communication training records on their Web site at <http://q.arc.nasa.gov/qh/training/>.

Each department maintains records of task-specific training and safety meetings.

Training records may be subject to periodic inspection.

Hygiene
Sampling and
Analysis
Records

The Division Safety Office maintains all industrial and hygiene sampling and analysis records.

Medical
Records

Specific medical test results are kept at the Ames Health Unit or the Camino Medical Group. All employee medical records are confidential and retained, transferred and made available in accordance with NASA ARC policies, and with the Code of Federal Regulations/ OSHA, 29 CFR 1910.20.

2.6. Definitions

Corrosive

A chemical that causes visible destruction of, or irreversible changes in, living tissue, such as discoloration, burning, blistering, or inflammation at the site of contact, or that has a severe corrosion rate on structural materials, such as metal. Acids and bases are corrosive.

Division Safety
Office

The safety office staffed by employees of the contracting company that supports the Wind Tunnel Operations Division on health, safety and environmental issues.

Flammable

A material that may ignite and burn rapidly under ordinary conditions. Liquids with a flashpoint below 1000° F and solids that ignite readily are flammable.

Hazard
Communication
Program

A document that provides more detailed information about hazards, hazardous materials, hazard recognition, hazard controls, physical and health effects of hazardous materials, emergency procedures, MSDS documents, and hazardous materials labeling. The Hazard Communication Program is maintained by, and available from, the Division Safety Office.

Hazardous
Material

As defined in Section 25501 of Chapter 6.95 of the California Health and Safety Code, a hazardous material is “any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment.” Hazardous waste is a hazardous material, as well as chemicals or a mixture of chemicals that can produce adverse physical effects, such as a fire or explosion; adverse health effects, such as dermatitis, irritation, or cancer; or environmental damage.

2. Hazard Communication and Handling Hazardous Materials

Health Hazards	Any material for which there is scientific evidence that acute or chronic health effects may occur in exposed persons. Carcinogens are health hazards, as well as toxic agents; reproductive toxins, such as mutagens and teratogens; irritants; corrosives; sensitizers; hepatotoxins (toxins that affect the liver); nephrotoxins (toxins that affect the kidney); neurotoxins (toxins that affect the nervous system); agents that act on the hematopoietic (blood) system; and agents that damage the lungs, skin, eyes, or mucous membranes.
Local Exhaust Ventilation	A ventilation method, such as a fume hood or a fume extractor, for removing contaminated air at the point where the contaminants are generated.
Material Safety Data Sheet (MSDS)	A document prepared by the chemical manufacturer to provide safety, health, and environmental information for a hazardous material.
National Fire Protection Association (NFPA)	The NFPA provides information on fire protection and prevention, and sets the standards for placard warning signs, such as signs using diamond-shaped symbols and numerals to identify hazardous materials and indicate the degree of hazard.
National Institute for Occupational Safety and Health (NIOSH)	NIOSH is an agency of the Public Health Service, U.S. Department of Health and Human Services (DHHS). NIOSH tests and certifies respiratory devices, recommends occupational exposure limits (REL), and assists OSHA by conducting research and investigations.
Occupational Safety and Health Administration (OSHA)	The government agency that develops and enforces occupational safety and health standards for most U.S. industry and business.
Oxidizer	A material that causes ignition of combustible materials without an external source of ignition. When combined with burning materials, an oxidizer increases the rate of burning. Oxidizers are fire hazards, usually unstable or reactive, often contain oxygen, and therefore can burn in an oxygen-free atmosphere.
Personal Protective Equipment (PPE)	Equipment that individuals wear to protect themselves against hazards in the environment. Respirators, gloves, safety glasses, safety shoes, harnesses for fall arrest, and hearing protectors are PPE.
Physical Hazard	Any combustible liquid, compressed gas, organic peroxide, or oxidizer that is explosive, flammable, pyrophoric, unstable (reactive), or water-reactive.

Reactivity	The ease with which a material can undergo change by reacting with another substance or by breaking down. Highly reactive materials may explode.
Respiratory Protective Equipment	Air cleaning equipment, such as a filter or a chemical absorbent cartridge, or air supply respirators that protect an individual from breathing airborne toxic materials.
Secondary Containment	A containment system that uses an impermeable, chemically-compatible secondary container to contain potential spills and leaks from a primary container. Secondary containment systems include bermed pads, trays, bins, or overpack drums. For details regarding capacity requirements for secondary containment, refer to the Division Hazard Communication Program.
Toxicity	All the adverse biological effects resulting from exposure to a hazardous material. Toxicity is determined by laboratory testing data on animals, and on human data from past accidental exposures.
Volatile Organic Compound (VOC)	Solvent compounds that evaporate into the air and affect the Earth's ozone layer.

2.7. References

Ames and Division Documents	<p>Ames Environmental Procedures and Guidelines, APG 8800.3</p> <p>Ames Health and Safety Manual, AHB 1700.1</p> <p>Building Emergency Action Plan (BEAP), all Wind Tunnel Operations Division Buildings</p> <p>The Division Environmental Compliance Plan, A327-9291-XS1</p> <p>The Hazard Communication Program, Wind Tunnel Operations Division</p>
Forms	<p>Hazardous Material Pickup Request Form, Form A</p> <p>Hazardous Materials Safe Work Procedure, FO8</p> <p>New Chemical Purchase Approval Form, FO9</p> <p>Purchase Request/Purchase Order—Special Approvers Routing Information</p> <p>Purchase Requisition Form</p> <p>Safe Plan of Action</p> <p>Weekly Inspection —Hazardous Materials and Waste Storage, FO4</p>

2. Hazard Communication and Handling Hazardous Materials

External Documents

California Health and Safety Code

Code of Federal Regulations/OSHA, 29 CFR 1910

Hazard Identification System, NFPA 704

End of Chapter

3. Safety Suggestion Program

3.1. Description

Purpose	The purpose of the Safety Suggestion process is to encourage staff to identify opportunities for workplace safety enhancement and communicate them to management for appropriate action.
Scope	This chapter applies to all employees, temporary workers, and support contractor personnel working under the authority of the Wind Tunnel Operations Division.
Limitations	Personnel should not submit safety suggestions for emergencies or in situations where conditions or activities pose an imminent danger to personnel, property, or the environment. These situations should be reported to Moffett Dispatch at extension 911, supervision, or the Division Safety Office as appropriate to ensure their timely correction.

3.2. Responsibilities

Managers	<p>Managers are responsible for the following:</p> <ul style="list-style-type: none">• Review submitted safety suggestions to determine appropriate actions.• Make resources available within their authority to implement accepted safety suggestions.• Ensure that no one takes actions to discriminate against or penalize personnel who submit safety suggestions.• Implement interim corrective or protective actions when permanent actions will be delayed due to personnel, material, or funding restraints.
Supervisors	<p>Supervisors are responsible for the following:</p> <ul style="list-style-type: none">• Evaluate submitted suggestions to identify situations that pose an imminent hazard to personnel, facilities, or the environment.• Take immediate action to control or correct hazards that pose an imminent hazard.• Determine if submitted suggestions accurately describe the situation.• Determine if corrective actions are within the limits of the individual's job assignment and authority to correct.• Recommend whether or not to implement suggestions.

3. Safety Suggestion Program

- Initiate actions within the limits of their responsibility and authority to control or correct the circumstances that resulted in the suggestion.
 - Forward all safety suggestions to the Division Safety Office.
-

Employees

Employees are responsible for the following:

- Identify workplace hazards and initiate action to correct those that are within the limits of their work assignment and authority.
 - Report emergencies or imminent danger situations to Moffett Dispatch, supervision, or the Division Safety Office immediately.
 - Submit safety suggestions as appropriate to identify personnel, process, facility, or equipment improvements.
-

Division Safety Office

The Division Safety Office is responsible for the following:

- Establish and maintain safety suggestion process and the requirements of this chapter.
 - Track and report status of submitted safety suggestions.
 - Assist management in evaluating suggestions and identifying appropriate actions.
 - Maintain the confidentiality of personnel who submit safety suggestions directly to the Division Safety Office and wish to remain anonymous.
-

3.3. Suggestion Process

General

Personnel covered by the scope of this chapter may submit suggestions to either of two safety suggestion processes. The Ames Research Center process managed by the Safety, Health, and Medical Services Division or the Wind Tunnel Operations Division process managed by the Division Safety Office. Personnel submitting suggestions to the Center process may be eligible for a cash award. Personnel submitting suggestions to the Division process will be eligible for Division recognition. The Division process is preferred over the Center process for issues that exist under Division authority because there are fewer processing delays.

All employees are responsible for identifying and correcting hazards that are present in the workplace within the limits of their work assignments and authority. Therefore, safety suggestions are generally limited to hazards in the workplace that cannot be corrected within these limits. The suggestion process contains provisions that allow confidential or anonymous submissions directly to the Division Safety Office in those instances where personnel have concerns about the potential for retribution from staff or management resulting from their suggestion.

3. Safety Suggestion Program

There may be delays in implementing permanent corrective actions or process improvements do to personnel, material, or funding restraints. In these instances, management shall evaluate the risk posed by existing circumstances or conditions and implement appropriate interim corrective or protective actions until implementation of a permanent solution.

Center Suggestion Process

Refer to the Ames Research Center Safety, Health, and Medical Services web site for instructions on submitting a safety suggestion to the Center Safety Suggestion process.

Division Suggestion Process

Employees shall proceed as follows to submit an employee safety suggestion using the Wind Tunnel Operations Division process.

Step	Action
1	Employees initiate a suggestion by completing the Employee Safety Suggestion form, FO7 and submitting it to their immediate supervisor for review.
	<p style="text-align: center;">NOTE</p> <p>Employees who wish their suggestion to be anonymous or confidential may do so by:</p> <ul style="list-style-type: none">• Submitting form to Supervisor without their name.• Submitting form to Division Safety Office without their name.• Submitting form to Division Safety Office with their name, but the confidential box checked.
2	The supervisor reviews and evaluates the suggestion for accuracy and to determine whether an imminent danger to personnel, equipment, or the environment exists.
3	The supervisor takes immediate action to correct or temporarily control imminent danger situations.
4	The supervisor completes the Supervisor Review Information portion of the form, including comments and recommendations.
	<p style="text-align: center;">NOTE</p> <p>The supervisor does not have the authority to approve or disapprove a suggestion, but may record their recommendations of implementation and the reasons for their recommendations on the form.</p>

3. Safety Suggestion Program

Step	Action
5	The supervisor forwards the suggestion to the Division Safety Office.
6	The Division Safety Office records the suggestion in a tracking system and works with others to evaluate the recommendations, assign actions as appropriate, track status, and report on processing status.

End of Chapter

4. Fall-Protection and Working at Heights

4.1. Description

Purpose	<p>Wind Tunnel Operations Division policy is to eliminate or control the potential for personnel injury resulting from falls from elevated work locations, falls into unguarded dangerous equipment, or by being struck by objects or materials that fall from elevated work locations. This shall be accomplished where feasible through installation of standard railings and through the installation of appropriate covers over floor and wall holes and openings. In instances where this is not feasible, personnel shall be protected by using fall-protection systems and by placement of temporary physical barricades to exclude personnel from hazardous areas. Any deviations from or exceptions to the requirements of this chapter must be approved in writing by the Wind Tunnel Operations Division Chief or the Support Contractor General Manager, or their designees, as appropriate.</p> <hr/>
Scope	<p>This chapter applies to all employees, temporary workers, visitors, support contractor personnel, and subcontractor personnel working under the authority of the Wind Tunnel Operations Division who, due to work locations and assignments, could experience one of the following:</p> <ul style="list-style-type: none">• A fall six or more feet to the ground or the next lower level. This includes falls from unprotected sides and edges, from leading edges, from or through hoist areas, and through holes in roofs and floors, including skylights and observation ports.• A fall into an uncontrolled hazard such as dangerous stationary or moving equipment, spaces with converging interior surfaces, containers of hazardous materials, or water that is deep enough for an individual to drown in. (This requirement applies regardless of the height of the fall.)• Injure others by dropping materials, tools, or equipment from heights onto personnel passing or working below them. <hr/>
Authority	<p>All personnel are authorized to refuse to perform work when conditions or practices associated with fall-protection or working at heights pose an imminent danger of injury or harm to personnel, facilities, or equipment.</p> <hr/>
Penalties	<p>Failure to follow the requirements of this chapter is grounds for disciplinary action up to and including discharge from employment.</p> <hr/>

4.2. Responsibilities

Managers

Managers have the following fall-protection responsibilities:

- Assure overall implementation and compliance with this chapter and any associated procedures.
 - Assure the availability of fall-protection equipment to support activities involving working at heights.
 - Assure that supervisors and employees are trained in working at heights and in using and caring for fall-protection equipment and systems.
-

Supervisors and Leads

Supervisors and leads have the following fall-protection responsibilities:

- Monitor work activities to assure compliance with this chapter.
 - Ensure personnel under their authority are trained and qualified to recognize potential fall hazards, and to select, use, and maintain fall-protection equipment and systems before assigning them to tasks covered by the scope of this chapter.
 - Ensure each job has been properly evaluated for fall hazards, and that those identified hazards have been controlled or eliminated before the start of work activities.
 - Participate in job planning for all work performed at elevation.
 - Ensure completion of Fall-protection Work Plans as required.
 - Ensure evaluation of anchorages before their use.
 - Ensure “keep-out” zones are marked and personnel who enter them wear the appropriate personal protective equipment.
 - Participate in the investigation of accidents involving fall-protection equipment and falling debris.
 - Prevent visitor access to fall hazard areas until they receive training or until their training and knowledge is verified.
-

Employees

Employees have the following fall-protection responsibilities:

- Perform their work in accordance with the requirements of this chapter and their training.
- Maintain awareness of hazards associated with working at heights and ensure that these hazards are addressed properly before starting work.
- Report any newly identified hazards associated with working at heights to their supervisor so they can be fully evaluated and controlled.
- Know the uses and limitations of fall-protection equipment.
- Inspect fall-protection equipment before each use and immediately remove any defective equipment from service.

4. Fall-Protection and Working at Heights

- Maintain fall-protection equipment in accordance with this chapter and their training.
 - Annually submit fall-protection equipment issued for their personal use to the designated Fall-Protection Specialist for inspection.
 - Report all falls covered by the scope of this chapter to the supervisor.
 - Immediately remove from use any fall-protection equipment subjected to a fall, and give it to the Division Safety Office so the designated Fall-Protection Specialist or equipment manufacturer can inspect it.
-

Division Safety Office

The Division Safety Office has the following fall-protection responsibilities:

- Provide overall guidance for the fall protection and working at heights program.
 - Provide assistance to site management in implementing the fall-protection program, training personnel, and monitoring work activities.
 - Provide the expertise and guidance necessary to help ensure adequate fall hazard protection.
 - Specify, purchase, and issue fall-protection equipment.
 - Assist supervisors with fall-protection assessment of their work activities.
 - Work with management to designate the “Designated Fall-Protection Specialist.”
-

The Designated Fall-Protection Specialist

The designated Fall-Protection Specialist has the following fall-protection responsibilities:

- Perform annual inspections of fall-protection equipment issued to individuals and issued through the tool cribs.
 - Perform inspections of damaged equipment turned into the tool crib.
 - Evaluate fall-protection equipment use.
 - Assist in job planning and the review of Fall-protection Work Plans.
 - Evaluate any substitutions or changes to a personal fall-arrest system before they are implemented to ensure that they meet the requirements of this chapter.
 - Lead investigations of accidents involving fall-protection equipment and falling debris.
-

Tool Crib Attendants	<p>Tool crib attendants have the following fall-protection responsibilities:</p> <ul style="list-style-type: none">• Perform visual and functional inspections of fall-protection equipment before each issuance.• Perform visual and functional inspections of fall-protection equipment upon its return to the tool crib.• Submit damaged or defective fall-protection equipment to the Designated Fall-Protection Specialist.• Assist the Designated Fall-Protection Specialist with the annual inspection of fall-protection equipment issued through the tool crib. <hr/>
Subcontractors	<p>Subcontractors have the following fall-protection responsibilities:</p> <ul style="list-style-type: none">• Demonstrate that they have trained their employees in the requirements and procedures that apply to fall protection and working at heights.• Perform work in accordance with the requirements contained within this chapter. <hr/>
Visitors	<p>Visitors have the following fall-protection responsibilities:</p> <ul style="list-style-type: none">• Obey signs and barricades erected to exclude personnel from areas with falling-material hazards.• Refrain from using personal fall-protection equipment unless specifically trained and authorized to do so by a representative of the Wind Tunnel Operations Division. <hr/>

4.3. Fall-Protection Requirements

Job Planning	<p>Managers, supervisors, shift leaders, and group leads shall ensure that each task involving working at heights is thoroughly planned and that the associated hazards are identified and controlled or eliminated before work begins. They shall also conduct additional planning, as necessary, in response to changes in the work scope. Job planning is the most important step in preventing exposure to the hazards associated with working at heights. Planning helps to define the scope of work, identify work site and work activity hazards, develop hazard elimination or control strategies, and complete the work efficiently.</p>
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The scope of work extends beyond the specific work task, such as replacing a limit switch, inspecting a vane set, or installing instrumentation on a model. It also includes:

- Obtaining and staging the materials or equipment specifically required to do the job (pumps, breakers, valves, paint, etc.).
- Obtaining and staging the required tools and supporting equipment (wrenches, ladders, personal protective equipment, aerial lifts, etc.).
- Identifying the specific sequence of steps and methods to be used to complete the task.
- Setting up to do the work (installing barricades and warning signs, disassembling equipment, rigging fall-protection anchorages, setting up cranes or aerial lifts, etc.).
- Reassembling equipment and cleaning-up (cleaning tools and equipment, packaging and labeling waste, removing barricades, removing rigging, etc.).

Once defined, the scope of work shall be used as the basis for hazard analyses and risk assessments, and for establishing boundaries on the activities to be performed.

Job Site Inspection

Job planning should always include visual inspections of the work area and the areas that immediately surround it. The purpose of the inspection is to identify potential hazards that will be directly associated with the work activities being planned and to identify conditions surrounding the work area that could result in injury or equipment damage. Consider the following hazards and questions while performing the inspection:

Work Area Access

- Who will require access to the work area?
- How will personnel gain access to the work location?
- Will personnel performing the work have to pass through areas that pose threats of injury due to hazardous conditions, materials, or processes?
- Can mobile equipment required to support the work activity reach the work area? Consider aerial lifts, cranes, scooters, etc.
- Can emergency response vehicles access the work area to assist in rescuing stranded or injured personnel?
- How will emergency response personnel gain access to injured or stranded personnel to perform a rescue?
- Are stairs, walkways, ladders, etc. in good condition and equipped with appropriate guardrails and handrails?
- Are there sufficient means of egress?

Falling Material Hazards (Impact Protection)

- Will it be possible to drop tools, equipment, or hazardous materials onto personnel working or passing below the elevated work area?
- Will existing conditions or other work activities in adjacent areas create falling material hazards for personnel performing the work activity?

Personnel Fall Hazards

- What type of fall hazards does the work activity pose? Falls to the same level? Falls to a different level? Falls into hazardous equipment? Others?
- Are there unguarded floor holes or openings, wall holes or openings, leading edges, open sided floors, etc?
- Will personnel be working from aerial lift devices?
- Are there appropriate anchorages for personal fall-arrest systems?
- Does the work pose any unique fall hazards that require the development of special fall-protection strategies?
- Will the risk of falls increase due to cold, wet, icy, hot, or windy conditions?
- Is there adequate lighting?

Adjacent Hazards

- Will there be hazards due to adjacent work activities? Consider falling objects or materials, noise, chemical exposure.
- Are there vehicle traffic hazards?
- Does equipment or projections on the structure pose striking or contact hazards to personnel?
- Are there housekeeping issues?

**Fall-Protection
Work Plan**

The Fall-Protection Work Plan, form FO3 is a tool to assist supervisors and the work crew in planning work that poses fall hazards or falling-debris hazards. Supervisors, shift leaders, and group leads shall ensure a Fall-Protection Work Plan is completed for each work activity that has potential for personnel to fall at least 6 feet or into hazardous equipment, and when one or more of the following is true:

- It is likely that the scope of work will change substantially once it begins.
- There are no permanent or designated anchorage points for the attachment of a fall-arrest system.
- Personnel rescue will require the assistance of specially trained and equipped emergency response personnel.
- It will be necessary to design and install special fall-restraint or fall-arrest systems to support the work activity.

- It will be necessary to climb to the work location using existing structural components (such as columns, beams, and ledges) rather than stairs, ladders, walkways, and aerial lifts.
- The work will pose unique fall hazards or take place in unique work locations with which the work crews have little or no experience.

Supervisors, shift leaders, and group leads shall:

- Review completed plans with all work crewmembers before work begins and following any plan revisions.
- Review and revise plans as appropriate following changes in work scope.
- Post completed plans in the associated work area.
- Ensure that personnel perform their assigned tasks in accordance with the posted plans.

Personnel
Rescue

Activities requiring personal fall-arrest equipment shall not begin unless there are means available to rescue victims within 15 minutes of a fall. Each job requiring fall-arrest equipment shall be evaluated to identify credible fall victim rescue scenarios. Once identified, each scenario must be reviewed to determine the required response actions. The review must also identify the need for special rescue skills, material, or equipment, and determine the availability of the emergency responders.

Work shall not commence until the work crew obtains and positions the rescue materials and equipment required and verifies the availability of emergency responders. Work in progress shall stop during any periods when resources required to perform a rescue are not available.

Equipment that may be required to support a rescue includes: aerial lifts, ladders, self-rescue devices such as automatic descent devices and friction devices, ropes, block and tackle apparatus, etc.

4.4. Hazard Elimination and Control

Description

There are two general methods for preventing injuries and damage due to falls and falling objects or debris:

- Take steps to eliminate or control the unsafe conditions and acts that create the hazards.
- Take steps to control the severity of the outcomes of a fall and falling debris.

Methods used to control the outcomes of accidents are subject to variable workplace conditions and the potential for human error. Therefore, the preferred method of preventing injuries and damage due to falls and falling debris shall be to eliminate or control the unsafe conditions or acts that cause or contribute to these accidents whenever feasible. The following sections describe ways of implementing accident prevention and control strategies.

Staying Within Scope of Work and Job Planning

Once work begins, employees and supervisors must remain aware of the planned work scope and identify changes in work locations, methods, or tasks that are beyond the original planning. Supervisors and employees must fully evaluate the effect of these changes and incorporate appropriate revisions into the planning documents, hazard elimination strategies, and hazard control strategies.

Impact Damage Prevention and Control

Personnel shall take the following steps to eliminate the potential for objects to fall:

- Cover floor holes and openings.
- Cover wall openings.
- Tether tools and equipment.
- Install standard toeboards or barricades around floor holes, openings, and along exposed edges.
- If toeboards are inadequate, then install paneling from the floor to an intermediate rail or to the top rail where standard toeboards will not be effective because material is piled above them.

Personnel shall take the following steps to control the severity of injuries or damage caused by falling debris:

- Install warning signs and barricades to exclude personnel from areas where falling debris may land.
 - Install impact protection over equipment that may be damaged by falling objects.
 - Require personnel to use personal protective equipment such as hard hats and safety glasses.
 - Place objects that are too large or heavy to be deflected by hard hats or other barriers away from edges and secure them to prevent falling when not in use.
-

Fall-Restraint Systems

Fall-Restraint Systems shall be used whenever feasible to eliminate fall hazards. Fall-restraint systems include physical barriers, warning lines, and systems comprised of a body harness, a connector, and an anchorage to restrain an individual from falling. Strength and design requirements for fall-restraint systems are less than those for fall-arrest systems.

Physical Barriers

Physical barriers include permanent or temporary standard railing systems, floor opening covers, manhole covers, wall opening screens, picket fences, half doors, swing gates, skylight screens, and permanent or temporary walls.

Warning Lines

Warning lines warn workers that they are approaching the edge of a fall hazard before they get close enough to fall. Warning line systems shall only be used in situations where it is not feasible to use guardrails, safety nets, or personal fall-protection equipment, and when working on flat surfaces and surfaces with a pitch less than 4in of drop per 12in of run.

Body Harness Systems

The body harness system consists of a body harness, connectors, and an anchorage. The body harness and connectors used for the fall-restraint application shall meet the same design and strength requirements as those specified for Fall-arrest Systems. Lifelines and connectors used with body harnesses shall limit the travel of personnel in a way that prevents them from reaching any sides and edges of the walking or working surface.

**Fall-Arrest
Systems**

Fall-Arrest Systems break falls. Personnel shall use Fall-arrest Systems whenever there is a potential for a free-fall, and when using fall-restraint systems are not feasible. There are two types of fall-arrest systems that may be used in Wind Tunnel Operations Division Facilities: body harnesses systems and safety net systems.

All fall arrest systems shall be designed to deploy and completely stop a fall without allowing the user to contact the next lower level. The design must also include shock absorbing devices to minimize the stopping forces experienced by the user and to minimize the potential for bouncing or swinging that may cause the user to strike nearby objects.

Body Harness Systems

Body harness system components are similar to those used for fall-restraint systems in that they are composed of a body harness, connector devices, and anchorages. The primary difference is in the strength requirements of the anchorages.

Safety Net

Safety net systems are not commonly used within Wind Tunnel Operations Division facilities. However, they can be used effectively to protect personnel from injuries due to falls when there are no fall-protection anchorages available at the work location.

4.5. Fall-protection System Design Requirements

Description	<p>Fall-protection systems and components must meet the design requirements specified below. Qualified engineering personnel and the Designated Fall-Protection Specialist shall design fall-restraint systems for each application. Features such as guardrails, handrails, and anchorages should be included as part of the overall design of a facility, tooling, support equipment, and models.</p>
Body Harnesses	<p>All body harnesses shall meet the design and testing requirements of ANSI Standard Z359.1 entitled “Safety Requirements for Personal Fall-arrest Systems, Subsystems, and Components.” Body harnesses are available in many different configurations to support a variety of work activities. Contact the Division Safety Office to obtain assistance in selecting a harness that is appropriate for your need.</p>
Connectors	<ul style="list-style-type: none"> • Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials. • Connectors shall have a corrosion-resistant finish and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system. • Lanyards and vertical lifelines which tie-off one employee shall have a minimum breaking strength of 5,000lbs. • D-rings and snap-hooks shall be capable of sustaining a minimum tensile load of 5,000lbs. • Connectors such as lanyards, snap hooks, and carabiners shall be a locking type designed to prevent disengagement when the keeper contacts the connected member.
Fall-arrest Anchorages	<p>An anchorage for personal fall-arrest equipment shall be capable of supporting $\geq 5,000\text{lbs}$ per employee attached to it. An anchorage shall be designed, installed, and used under the supervision of a qualified person as part of a complete personal fall-arrest system that maintains a safety factor of at least two.</p>
Fall Restraint and Positioning Anchorages	<p>Anchorage used for fall restraint and positioning purposes shall be capable of supporting at least twice the potential impact load of an individual’s fall or 3,000lbs, whichever is greater. If the anchorage will be used concurrently by more than one person, the number of concurrent users shall multiply the 3,000lbs requirement.</p>

Floor Opening Covers

Floor opening covers may be constructed of any material that meets the following strength requirements:

- Covers shall be capable of supporting at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time.
- Covers shall not project more than 1 inch above the floor level. Cover edges shall be chamfered to an angle $\leq 30^\circ$. All hinges, handles, bolts, or other parts shall be set flush with the floor or cover surface.
- All covers shall be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees.
- All covers shall be color coded or marked with the word "HOLE" or "COVER" to provide warning of the hazard.

Horizontal Lifelines

Lifelines shall be attached to anchorages that are independent of all other equipment. Horizontal lifelines are anchoring lines rigged between two anchorages on the same level. They provide the user with a great deal of mobility and continuous fall protection across large distances. However, the design of horizontal lifeline systems is extremely critical due to the number of variables that can affect their safety and effectiveness. These variables include the design load, the length of the lifeline between supports, the clearance above and below the work area, the size and type of lifeline used (i.e. steel cable, synthetic rope), and the type of connectors used.

- A qualified person shall design horizontal lifeline systems for each individual application.
- The design must provide a safety factor of at least two under all use conditions.

Safety Nets

Safety nets shall be installed as close as practicable below the surface where employees are walking or working, but in no case more than 30ft below such level. Safety nets shall extend outward from the outermost projection of the work surface as follows:

Vertical distance from working level to horizontal plane of the outer edge of the net.	Minimum required horizontal distance from the edge of the working surface.
5 feet or less	8 feet
Between 5 and 10 feet	10 feet
10 feet or more	13 feet

Safety nets shall be installed with sufficient clearance under them to prevent contact with the surface or structures below when subjected to an impact force equal to the drop test specified below.

Safety nets and their installations shall be capable of absorbing an impact force equal to that produced by the drop test specified below.

Safety nets and safety net installations shall be drop tested at the job site after initial installation and before being used as a fall-protection system, whenever relocated, after major repair, and at 6-month intervals if left in one place. The drop test shall consist of a 400lbs bag of sand 30 ± 2 in in diameter dropped into the net from the highest surface at which employees are exposed to fall hazards. In all drop tests, the bag shall be dropped from a minimum distance of 42in above the safety net.

The maximum size of each safety net mesh opening shall not exceed 36in² nor longer than 6in on any side, and the opening, measured center-to-center of mesh ropes or webbing, shall not be longer than 6in. All mesh crossings shall be secured to prevent enlargement of the mesh opening.

Each safety net (or section of it) shall have a border rope for webbing with a minimum breaking strength of 5,000lbs.

Connections between safety net panels shall be as strong as integral net components and shall be spaced not more than 6in apart.

Skylight
Screens

Skylight screens shall be capable of withstanding a load of at least 200lbs applied perpendicularly to any one area on the screen. They shall be of such construction and mounting that under ordinary loads or impacts, they will not deflect downward and break the glass below them. The construction shall be grillwork with openings no more than 4in long or slatwork with openings no more than 2in wide.

Standard
Railings

Standard railings shall meet the following requirements:

- Standard railings shall consist of a top rail, an intermediate rail, and posts.
- The top rail shall be smooth with its upper surface 42in from the floor, platform, runway, or ramp level.
- Protection between top rail and floor, platform, runway, ramp, or stair treads, equivalent at least to that provided by an intermediate rail.
- The intermediate rail shall be approximately halfway between the top rail and the floor, platform, runway, or ramp.
- The rail ends shall not overhang the terminal posts except where such overhang does not constitute a projection hazard.
- The anchoring of posts and framing of members for railings of all types shall be constructed to withstand a load of at least 200lbs applied in any direction at any point on the top rail.
- Mid-rails shall be capable of withstanding a force of at least 150lbs applied in any downward or outward direction.

When constructed of wood, the posts shall be 2in by 4in stock and spaced at 6ft or less intervals. The top and intermediate rails shall be 2in by 4in stock. If the top rail is made of two of 1in by 4in stock at right angles, posts may be spaced on 8ft centers, with a 2in by 4in intermediate rail.

When constructed of pipe, posts and top and intermediate railings shall be at least 1 1/2in nominal diameter with posts spaced not more than 8ft on centers.

When constructed of structural steel, posts and top and intermediate rails shall be of 2in by 2in by 3/8in angles or other metal shapes of equivalent bending strength with posts spaced not more than 8ft on centers.

Standard
Toeboards

Standard toeboards may be of any substantial material that is either solid or has openings ≤ 1 in. They shall be 4in from the top edge to the floor, platform, runway, or ramp. They shall be securely fastened with $\leq 1/4$ in clearance above floor level. Toeboards shall withstand a force of at least 50lbs applied in any downward or outward direction.

Where material is piled to such height that a standard toeboard does not provide protection, paneling from the floor to the intermediate rail or to the top rail shall be provided.

Vertical
Lifelines

Lifelines shall be attached to anchorages that are independent of all other equipment.

- Vertical lifelines must be equipped with a formed eye termination connector at one end for attachment to the anchorage.
 - The components of self-retracting lifelines and lanyards that limit free-fall distance to ≤ 2 ft shall be capable of sustaining a minimum static tensile load of 3,000lbs.
 - Self-retracting lifelines and lanyards that do not limit free-fall distance to ≤ 2 ft, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,000lbs.
 - Vertical lifelines which tie-off one employee shall have a minimum breaking strength of 5,000lbs.
-

Wall Opening
Barriers

Wall opening barriers (rails, rollers, picket fences, and half doors) shall be constructed and mounted to withstand a load of ≥ 200 lbs, applied in any direction at any point on the top rail or a corresponding member.

Wall Opening
Screens

Wall opening screens shall be constructed and mounted to withstand a load ≥ 200 lbs horizontally applied at any point on the near side of the screen. They shall be of solid construction either of grillwork with openings ≤ 8 in long or of unrestricted length slats with openings ≤ 4 in wide with.

Warning Lines

Warning line systems shall be used only on flat surfaces and surfaces with a pitch ≤ 4 in of drop per 12in of run. They shall be erected ≥ 6 ft from the edge around all sides of a fall-hazard. Warning lines shall consist of ropes, wires, or chains, and supporting stanchions erected as follows:

- The rope, wire, or chain shall be flagged with high visibility material at ≤ 6 ft intervals.
 - The rope, wire, or chain shall be rigged and supported so its lowest point is ≥ 34 in above the surface. At its highest point, the rope, wire, or chain shall be ≤ 39 in above the surface.
 - The stanchions (with rope, wire, or chain attached) shall withstand a force ≥ 16 lbs applied horizontally against the stanchion at 30in above the surface, in the direction of the surface edge and perpendicular to the warning line.
 - The rope, wire, or chain shall have a tensile strength ≥ 500 lbs.
 - The rope, wire, or chain shall support the loads (as specified above) applied to the stanchions without breaking.
 - The rope, wire, or chain shall be attached at each stanchion so pulling on a section between stanchions does not result in slack being taken up in adjacent sections.
-

4.6. Use of Fall-Protection Equipment

Description

Standard-issue personal fall-protection systems and components shall not be used when the combined weight of the user and any tools and equipment they will be carrying exceeds 310lbs. When the combined weight exceeds 310lbs, a special engineering evaluation will be required to ensure that the system meets or exceeds minimum safety factor requirements. Individuals whose weight exceeds 310lbs shall not use personal fall-protection systems unless specifically authorized by management and a Designated Fall-Protection Specialist.

Following is a list of general fall-protection equipment use requirements. Requirements that apply specifically to fall-restraint or arrest equipment, or to special situations are listed in the appropriate subsections.

- Fall-protection equipment and systems must be designed, purchased, and used in accordance with the applicable manufacturer's specifications, regulatory requirements, and the requirements contained within this chapter.
- Only equipment that is provided by or approved by the Designated Fall-Protection Specialist shall be used for fall-protection purposes.
- Fall-protection equipment that may be suitable for other purposes, such as cables, ropes, lanyards, beam trolleys, beam clamps, etc. shall be used for the designated fall-protection functions only.
- Only full-body harnesses shall be used for fall protection.

- Only back-mounted D-rings shall be used for fall-arrest purposes.
 - Front-mounted D-rings shall only be used for attaching to climbing systems (such as ladder safety devices).
 - Shoulder-mounted D-rings shall be used only for lowering, raising and rescue purposes.
 - Side-mounted D-rings shall only be used for positioning purposes.
 - Users shall inspect fall-protection equipment before each use.
 - Users shall maintain fall-protection equipment in good condition at all times.
 - Users shall remove damaged or dysfunctional equipment from service immediately and give it to the designated Fall-Protection Specialist for inspection.
 - Users shall remove any fall-protection equipment that was subjected to a fall from service immediately and give it to the Designated Fall-Protection Specialist for inspection.
 - Only anchorages that have been evaluated and approved by the Designated Fall-Protection Specialist or a qualified engineer shall be used for fall-restraint or fall-arrest protection.
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Aerial Lifts

The following shall apply when aerial lifts are used:

- Each individual in the basket shall wear a body harness and lanyard attached to the basket or boom.
 - Users shall not attach lanyards to adjacent structures or equipment while working from aerial lifts.
 - Harnesses and lanyards are not required for occupants of scissors-lifts that have properly installed and functional guardrails.
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Deceleration Devices

Deceleration or shock-absorbing devices shall be used with all personal fall-arrest systems except those with self-retracting lifelines or lanyards, or where lanyards are installed to limit a free-fall to less than 42in. Multiple deceleration devices shall not be used in series in a personal fall-arrest system.

Fall-restraint versus Fall-arrest Systems

Fall-restraint systems shall be used as the preferred method of preventing personnel injury due to falls. In instances where it is not feasible to install fall-restraint systems, fall-arrest systems shall be used to reduce the risk of injury due to falls. Fall-arrest systems shall be used to reduce the risk of injury in all situations where a fall hazard exists and it is not feasible to install fall-restraint systems or during interim periods while fall-restraint systems are being designed and installed.

Ladders, Fixed	<p>The following shall apply when fixed ladders are used:</p> <ul style="list-style-type: none">• Cages or other permanent fall-protection devices (such as sliding rail systems) shall be installed on fixed ladders that are higher than 20ft.• Where a cage or other permanent fall-protection device is not feasible, a temporary fall-protection system, such as a vertical or self-retracting lifeline, shall be installed to support the work activity. <hr/>
Ladders, Portable	<p>It is not possible to use fall-restraint or fall-arrest equipment in many temporary work locations where personnel must use portable ladders. The following shall apply when using portable ladders:</p> <ul style="list-style-type: none">• Use the correct type and size of ladder for the job.• Inspect ladders before use to ensure that they are in good condition and working properly.• Do not use damaged ladders. Remove them from service immediately.• Secure extension ladders at the top and bottom whenever possible to prevent them from moving. If this is not possible, assign a second individual to hold the ladder in place.• Install extension ladders at the correct angle of 1ft out from the base for every 4ft of elevation.• Extend the rails of extension ladders 3ft above the walking or working surface.• Use a rope or line to hoist tools and materials to the work location rather than carrying them up the ladder.• Do not tie ladders together.• Use stepladders in the fully opened and locked position only..• Do not use ladders in a horizontal position as a scaffold plank or work platform.• Keep the access areas to ladders free of debris and stored materials. <hr/>
Lanyards	<p>The following shall apply when lanyards are used:</p> <ul style="list-style-type: none">• Always use the shortest possible lanyard length.• Lanyards shall be sized, adjusted, or installed so the maximum fall distance is 6ft.• Lanyards must be used in conjunction with shock absorbers or a shock absorbing system, except when they are self-retracting, or where they are installed to limit a free-fall to less than 42in.• Lanyards must never contain knots.• No more than one person may be attached to a single lanyard.

- Lanyards that are not in use shall be secured to prevent tripping or entanglement.
 - Only non-conductive lanyards shall be used when performing work near energized electrical equipment.
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Lifelines,
Horizontal

The following shall apply when horizontal lifelines are used:

- Only one individual at a time may use a horizontal lifeline system, unless it is specifically designed for use by more than one individual.
 - When horizontal lifelines may become vertical lifelines (such as due to a component failure), the rope grab device used to connect to the lifeline shall be capable of locking in both directions on the lifeline.
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Lifelines, Self-
Retracting

The following shall apply when self-retracting lifelines are used:

- Self-retracting lifelines shall be installed and used so the lifeline maintains an angle that is less than 45° from the vertical.
 - Self-retracting lifelines requiring periodic inspections by the manufacturer shall not be used unless the inspection certification is current.
-

Lifelines,
Vertical

The following shall apply when vertical lifelines are used:

- Vertical lifelines shall only be used by one individual at a time.
 - The bottom end of a vertical lifeline must extend below the lowest level of vertical travel, and be attached to a second anchorage, or weighted to provide stability.
 - “Rope Grab” devices used with vertical lifelines must be selected to be compatible with the type and size of the lifeline being used.
 - Rope grabs shall remain positioned above shoulder height during use.
 - The length of lanyards used with vertical lifelines must meet the manufacturer’s specifications for the rope grab being used.
-

Safety Nets

The following shall apply when safety nets are used:

- Defective nets shall not be used.
 - Materials, scrap pieces, equipment, and tools which have fallen into the safety net shall be removed as soon as possible from the net and before the next work shift.
 - Defective components shall be removed from service immediately.
-

Scaffolds

The following shall apply when using scaffolds:

- Each employee on a scaffold more than 6ft above a lower level shall be protected from falling to that lower level.
- Standard guardrails or fall-arrest systems shall be used to protect personnel wherever the front edge of a platform is more than 14in from the face of the work.
- Fall-arrest systems or positioning devices shall be used where the integral prefabricated scaffold access frames with rungs shorter than 11 1/2in are used as work platforms.
- Fall-arrest systems or windscreens may be used to protect personnel working on scaffolds during storms and in high winds when the designated Fall-Protection Specialist has determined that it is safe to do so.
- Windscreens shall not be used unless the scaffold is secured against the anticipated wind forces.
- The designated Fall-Protection Specialist shall determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds.
- Fall-arrest systems used on scaffolds shall be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member.
- When vertical lifelines are used, they shall be fastened to a fixed safe point of anchorage that is independent of the scaffold and shall be protected from sharp edges and abrasion.
- Structural members of buildings shall be used as safe points of anchorage, but standpipes, vents, other piping systems, electrical conduit, outrigger beams, or counterweights shall not be used.
- Vertical lifelines, independent support lines, and suspension ropes shall not be attached to each other, to the same point of anchorage, or to the same point on the scaffold or fall-arrest system.

Travelling
Between
Locations

Personnel traveling between locations while working at a height shall use fall-protection systems such as standard guardrails, vertical or horizontal lifelines, ladder cages, or other ladder safety devices, or the use of either two lanyards or a “Y” lanyard. When using two lanyards or “Y” lanyards, one of the lanyards or lanyard legs shall be attached to an anchorage at all times.

4.7. Inspections

User Inspections	<p>Users shall inspect fall-arrest equipment for damage or defects before each use. Any damaged or defective equipment shall be removed from service immediately and given to the Support Contractor Safety Department to be evaluated. Users shall specifically inspect harnesses, lanyards, and connectors for the damage and defects listed in the inspection criteria sections below.</p>
Designated Fall-Protection Specialist Inspections	<p>The Designated Fall-Protection Specialist shall perform annual inspections of all fall-protection equipment. This includes equipment issued to individuals for personal use and equipment issued through the tool cribs. These inspections will verify that fall-protection equipment is in good condition and operates correctly, and ensures equipment is being sent to manufacturers for inspections and servicing as required. The inspections performed on equipment issued for personal use shall include discussions with the users to evaluate their knowledge of equipment limitations and inspection requirements.</p> <p>The Designated Fall-Protection Specialist shall inspect safety nets at least once a week for wear, damage, and other deterioration. They shall also inspect them immediately following any occurrence that could affect the integrity of the safety net system.</p>
Tool Crib Attendant Inspections	<p>Tool crib attendants shall inspect fall-protection equipment for obvious defects or damage before issuing it and when it's returned. Tool crib attendants shall not issue equipment that shows signs of defects or damage. Defective or damaged equipment shall be marked as damaged or defective and segregated from other equipment and shall not be issued until the Designated Fall-Protection Specialist inspects it and approves its continued use.</p>
Inspection Criteria for Body Harness Systems	<p>Inspection criteria for body harness systems includes inspecting belts, buckles, D-rings, and webbing.</p> <p>Belts</p> <p>Inspect belts for the following damage or defects:</p> <ul style="list-style-type: none"> • Loose or distorted tongue. • Missing grommets. • Extra holes. • Transverse cracks that form when webbing is bent over a mandrel. • Loss of elasticity.

Buckles

Inspect buckles for the following damage or defects:

- Tongue buckles that are distorted in shape or movement.
- Tongues that do not overlap the buckle frame.
- Tongues that do not move freely back and forth in the socket.
- Buckle rollers that do not turn freely, are distorted, or have sharp edges.
- Friction buckles that are distorted, have bent or distorted outer and center bars, or bent or distorted corners.

D-Rings

Inspect D-rings for the following damage or defects:

- Distorted metal wear pads.
- Cracks, breaks, or rough or sharp edges.
- D-rings that are not perpendicular to the belt or do not pivot freely.

Webbing

Inspect webbing for the following damage or defects:

- Frayed edges, broken or cut fibers, holes, or pulled or loose stitches.
- D-ring and buckle attachments that show unusual wear or that have frayed or cut fibers.
- Heat-damaged areas that are brittle and break when flexed, or that have a shriveled brownish appearance.
- Chemical damage that may appear as brown smears or smudges, the formation of transverse cracks where webbing bends over a mandrel, or the loss of elasticity.
- Strands that are fused together, have hard shiny spots, or feel hard and brittle.
- Paint damage that penetrates and restricts movement of the fibers.

Inspection
Criteria for
Lanyards and
Lifelines

Inspection criteria for lanyards and lifelines includes inspecting rip-stop arresting devices, cables, connectors and fittings, ropes, and webbing.

Rip-Stop Arresting Devices

Inspect rip-stop arresting devices for the following damage or defects:

- Burn holes and tears.
- Loose strands, rips, and deterioration of stitching on areas where the pack is sewn to D-rings, belts, or lanyards.

Cables

Inspect cables for the following damage or defects:

- Cuts, frayed areas, or unusual wearing patterns on the wire.
- Broken strands that separate from the body of the cable when twisted.

Connectors and Fittings

Inspect connectors and fittings for the following damage or defects:

- Snaps that have hook and eye distortions, cracks, corrosion, or pitted surfaces.
- Keepers that are distorted or obstructed and do not seat into the nose without binding.
- Keeper springs that exert insufficient force to firmly close the keeper.
- Keeper locks that prevent the keeper from opening.
- Thimbles that do not seat firmly in the in the eye of a splice.
- Splices that have loose or cut strands.
- Thimbles that have sharp edges, distortions, or cracks.

Ropes

Inspect ropes for the following damage or defects:

- Fuzzy, worn, broken, or cut fibers that appear as the rope is rotated from end-to-end.
- Noticeable changes in the original diameter. (Following a short break-in period, the rope diameter should be uniform throughout its length.)

Webbing

Inspect webbing for the following damage or defects:

- Cuts, snags, or breaks that appear while bending the webbing over a pipe or mandrel.
 - Swelling, discoloration, cracks, charring or obvious signs of chemical or heat damage.
 - Any breaks in the stitching.
 - Any activation of warning flags built into Miller Manyards®.
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4.8. Accident Investigation

Description

The Designated Fall-Protection Specialist and appropriate supervisor shall investigate all accidents involving fall-protection equipment and debris falling from overhead work. The purpose of the investigation shall be to identify accident causes; to identify actions required to prevent future occurrences, and to evaluate the effectiveness of the methods used for personnel and equipment protection.

4.9. Training

Initial Training	<p>Personnel shall receive initial fall protection and working at heights training prior to being assigned to tasks covered by the scope of this chapter. The training shall include:</p> <ul style="list-style-type: none"> • The contents of this chapter. • Limitations on the use of fall-protection equipment. • The nature of fall hazards in the work area. • The correct procedures for erecting, maintaining, disassembling, and inspecting the fall-protection system to be used. • The use and operation of personal fall-arrest systems and other protection to be used. This shall include: proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level; the severity of consequences of improper use (such as using knots, tying around sharp edges, etc.) • The correct procedures for the inspection, handling, and storage of equipment and materials. • The role of employees in fall-protection plans. • The OSHA standards pertaining to fall protection.
Refresher Training	<p>Refresher training shall be provided whenever:</p> <ul style="list-style-type: none"> • A change in job assignments poses the potential for new hazards associated with fall protection or working at heights. • There is a change in the requirements of this chapter or the associated equipment or processes. • An individual demonstrates a lack of knowledge or understanding of hazards associated with the use of fall-protection equipment or working at heights.

4.10. Definitions

Aerial Device	Any vehicle-mounted device, telescoping or articulating, or both, which is used to position personnel. This includes scissors-lifts and telescopic or extensible boom lifts such as “JLGs.”
Authorized Personnel	Individuals whose work assignments or locations meet the criteria specified by the scope of this chapter, are trained in, and have demonstrated competence in the selection, use, and care of fall-protection equipment and systems.

Anchorage	A secure point of attachment for lifelines, lanyards or deceleration devices that is capable of withstanding the loads specified by this chapter. Examples include eyebolts and welded eyes, structural steel, and welded steel pipe.
Body Harness	Fall-protection equipment consisting of straps which may be secured about the individual in a manner that will distribute the fall-arrest forces over the thighs, pelvis, waist, chest and shoulders.
Connector	A device used to connect parts of the personal fall-arrest system and positioning device systems together. Connectors may be an independent component of the system such as a carabiner, or an integral component, such as a buckle or D-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard.
Dangerous Equipment	Equipment such as rotating machinery, electrical equipment, and other units which as a result of form or function may be hazardous to employees who fall onto or into such equipment.
Deceleration Device	Any mechanism, such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines or lanyards, etc., which dissipates energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.
Designated Fall-Protection Specialist	To satisfy regulatory requirements for a “Competent Person”, an individual who is capable of identifying hazardous conditions regarding fall-protection equipment, is knowledgeable in the application and use of the equipment, and has the authority to take prompt corrective actions is designated as a Fall-Protection Specialist.
Fall-arrest System	A system composed of multiple approved safety equipment components that are interconnected and rigged to stop a free fall such as body harnesses, lanyards, deceleration devices, drop lines, horizontal or vertical lifelines and anchorages.
Fall-restraint System	Components that function together to prevent an individual from falling to a lower level or into dangerous equipment. Fall-restraint devices include permanent and temporary guardrails, monitors, and positioning devices.
Floor Hole	A gap or void ≥ 2 in (5.1 cm) in a floor, roof, or other walking or working surface.
Floor Opening	An opening measuring ≥ 12 in in any floor, platform, pavement, or yard such as a hatchway, stair or ladder opening, pit, or large manhole. Floor openings occupied by elevators, dumb waiters, conveyors, machinery, or containers are excluded.
Free Fall Distance	The distance the harness D-ring travels from the onset of a fall to the time when the fall-arrest system activates. (It excludes any deceleration distance and any system elongation.)

Imminent Danger	Any conditions or practices posing an immediate danger which could be expected to cause death, serious physical harm, or serious damage to facilities or equipment.
Leading Edge	The unprotected edge of a floor, roof, decking, or forms for a floor or other walking or working surface as it is being constructed.
Life Line	A flexible line connected to an anchorage at one end as a vertical lifeline, or connected at both ends as a horizontal lifeline and to which other elements of a fall-arrest system are attached.
Lower Levels	Any areas or surfaces to which an employee can fall.
Personal Fall-arrest System	A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, a body belt or body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.
Positioning Device System	A body harness system to support an employee on an elevated vertical surface such as a wall to allow work with both hands free.
Qualified Person	An individual with a recognized degree or professional certificate and extensive knowledge in the applicable field who is capable of designing, analyzing, evaluating, and specifying the fall-protection structures or equipment required to support activities involving working at heights.
Rope Grab	A deceleration device that travels on a lifeline and uses friction to automatically engage the lifeline to arrest the fall. A rope grab usually employs the principle of inertial locking, cam or level locking, or both.
Wall Opening	A gap or void ≥ 30 in high and ≥ 18 in wide in a wall or partition through which an individual could fall.

End of Chapter

5. Environmental Compliance

5.1. Description

Purpose	<p>The purpose of this chapter is to describe requirements and processes that implement the Division policy to protect the environment, general public, and all personnel from the hazards posed by improperly controlled hazardous materials.</p> <p>For other requirements regarding hazardous materials, refer to the chapter on Hazard Communication and Handling Hazardous Materials. For more detailed information, refer to the Division Hazard Communication Program and regulatory documents available in the Division Safety Office.</p>
Scope	<p>This chapter applies to anyone under the authority of the Wind Tunnel Operations Division, including civil servant, support contractor, and temporary personnel whose activities involve using or disposing of hazardous materials.</p>

5.2. Responsibilities

Managers	<p>Managers' responsibilities include the following:</p> <ul style="list-style-type: none">• To implement the procedures described in this chapter.• To be aware that complying with environmental compliance regulations is a statutory obligation.• To ensure that personnel reporting to them comply with the requirements of this chapter.• To ensure all environmental and safety issues are properly handled.• To provide personnel all training and resources that comply with the requirements of this chapter.
Supervisors	<p>Supervisors' responsibilities include the following:</p> <ul style="list-style-type: none">• To ensure that personnel reporting to them comply with the requirements of this chapter.• To ensure that personnel are aware that complying with environmental compliance regulations is a statutory obligation.• To ensure the safe handling of hazardous materials by the people under their supervision.• To assure that personnel are familiar with and act in accordance with required procedures.• To properly train personnel who acquire, store, use, generate, and dispose of hazardous substances.

5. Environmental Compliance

- To train employees on proper emergency response and spill-prevention procedures.
- To ensure that an Material Safety Data Sheet (MSDS) is obtained for each hazardous substance that is acquired and that an MSDS work place file is maintained.
- To ensure that all employees are properly trained annually and the training records for those employees are kept to 30 years.
- To assure that each employee has ready access to the MSDS file and has read and reviewed the file contents.
- To indicate which of the substances used and waste generated by their personnel are hazardous.
- To assure that only “safe” amounts of various hazardous substances are authorized to be kept in the work station/ laboratory. A safe amount is generally considered to be one-week supply or less.
- To assure that labeling is appropriate (adequate to identify material and its hazard) on each chemical container and that the container is properly stored (flammable locker, secondary containment, compatible chemicals, etc.).
- To conduct an annual chemical inventory to be submitted to the ARC Safety, Environmental and Mission Assurance Office.
- To personally attend annually 8 hours of chemical/hazardous material training courses to comply with Occupational Safety and Health Administration (OSHA) and EPA requirements. This training gives supervisors the ability to subsequently train their employees on hazardous material handling.
- To establish spill control stations for all areas where hazardous substances and wastes are accumulated.
- To assure that an Extremely Hazardous Substance Request/ Permit (AHB 1700.1) and its associated MSDS are obtained and posted for extremely hazardous substances.
- To appoint one employee to make a weekly inspection of all hazardous substance storage areas and log the results on the appropriate form.
- To ensure that hazardous waste is disposed of properly.

Hazardous Material Users

Hazardous material users’ responsibilities include the following:

- To comply with the requirements of this chapter.
- To be aware that complying with environmental compliance regulations is a statutory obligation.
- To never handle, use, clean up, or dispose of any hazardous material in which they are not properly trained.
- To be familiar with the properties of hazardous materials they use.

- To know the contents of the work area MSDS binder, and know its permanent location for ready access in the event of an emergency.
 - To understand and comply with all procedures for handling hazardous substances.
 - To know contingency actions that must be taken immediately if the unexpected occurs, e.g., a hazardous material spill.
 - To attend annual required training and re-certification, e.g., hazardous materials management, hazard communications, etc.
 - To report difficulties and recommend improvements to their supervisors on procedures for handling hazardous substances.
 - To assure that all chemical containers are labeled as required and are secondarily contained.
 - To fill out appropriate weekly logs.
-

5.3. General Requirements

Bay Area Air Quality Management District Regulations

The EPA and the Bay Area Air Quality Management District (BAAQMD) require daily record keeping of permitted coating and solvent usage for all areas of Ames. Certain permits, issued by the BAAQMD, impose operating conditions such as solvent-use record keeping. In many cases, permits for solvent-use sources require daily records. Record keeping is also required for coating operations. Check the specific conditions for the sources operated in your area. The BAAQMD also regulates the solvent content of many consumer products such as paints, spray paints, resins, and adhesives. The BAAQMD prohibits the sale or use of materials in this area that do not meet their specifications for solvent content. Please check the MSDS of the material you intend to purchase for use and check its Volatile Organic Compound (VOC) content against the BAAQMD requirement for that material and application. Contact the Division Safety Office or the ARC Safety, Environmental and Mission Assurance Office for assistance.

General regulations include:

- Complete the appropriate forms every time one of these materials is used.
 - The area supervisors are responsible for ensuring that their employees report all usage.
 - These forms are to be sent to the Division Safety Office by the third of each month for the previous month's usage.
 - All coatings must meet BAAQMD VOC limits.
 - Any source of VOCs could require a permit. Check with the ARC Safety, Environmental and Mission Assurance Office.
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**Hazardous
Waste
Minimization**

One of the most cost-effective approaches to the hazardous waste problem is waste minimization. Division policy is to minimize the generation of hazardous waste by implementing source reduction, reuse and recycling, and treatment, as described below:

Source Reduction

Whenever possible, non-hazardous materials should be substituted for hazardous materials, or the process should be modified to eliminate or reduce the quantity of hazardous waste generated. For example, Envirosolv is the preferred general-purpose cleaner to replace Freon.

Reuse and Recycling

To the extent that is feasible, spent hazardous materials must be reused or recycled for reuse. An example is recycling waste oils.

Treatment

Hazardous waste that cannot be reduced, reused, or recycled shall be treated, if technically and economically feasible, to reduce its volume and its hazardous properties. An example of such treatment is neutralizing corrosive materials.

Hazardous treatment waste units are subject to tiered permitting requirements. Notify the Division Safety Office and/or ARC Safety, Environmental and Mission Assurance Office prior to installing hazardous waste treatment units.

**Waste
Accumulation
and Disposal**

Waste materials must be separated into groups. Materials within a group may be mixed with other materials in the same group in a 55-gallon drum. Materials must not be mixed with materials from a different group due to extremely high cost of disposal when materials are mixed. these groups are:

Group 1

- Freons (halogenated solvents.)
- Trichlorotrifluoroethane.
- Fluorosolvent T.F.

Group 2

- Used oils and compatible hydrocarbons Mobile and other lubricating oils.
- Kerosene.
- Jet Fuel (JP5 or JP8).

Group 3

- Flammable solvents (nonhalogenated).
- Acetone.
- Turpentine.

- Petroleum naptha.
- Stoddard solvent.

Group 4

- Contaminated solids.
- Asbestos, paint, and other hazardous waste must be separated.

Container Management

All hazardous waste drums must be maintained in the following manner:

- Containers must be marked with accumulation start date, the words “Hazardous Waste,” and a description of the contents i.e. “Acetone, flammable”.
- Containers must be repacked if not in good condition, e.g., severe rusting, apparent structural defects.
- Containers must be compatible with the waste.
- Container must be securely closed unless waste is being added or removed.
- Containers must be inspected weekly for leakage and deterioration.
- Incompatible wastes must not be placed in the same container.
- Secondary containment of all containers is required. If the material is being placed in a bag for storage, then the material must be “double bagged.” Both bags must have a hazardous waste label if needed.

Hazardous Waste Labeling

All waste containers must have the Hazardous Waste Accumulation label on the container. The label is to be filled out completely at the accumulation start date including physical state, hazard, and container contents.

Hazardous Waste Accumulation Time Restrictions

Accumulation time is limited to 90-day on site except when area is designed as a satellite accumulation area. Contact the ARC Safety, Environmental and Mission Assurance Office to obtain a satellite accumulation area designation. Containers limited to 90 days on site must be scheduled for pick-up within 50 days of the accumulation start date. If the drum is considered to be a satellite accumulation container, then it must be moved to the Division hazardous materials storage area within three days of reaching the quantity limits (55 gallons of hazardous waste or 1 quart of extremely hazardous materials) or within nine months of accumulation start date, whichever comes first.

Hazardous Waste Removal

When a container is full or the time restriction on the container is met, then a Hazardous Waste Pick-up Request is to be filled out and sent to the designated waste contractor. Prior to pick-up, assure containers are securely closed and there is no residual chemical/rainwater on outside of container.

Empty Containers (Drums)	<p>An empty container is a recyclable 55-gallon steel container with less than 1-inch of residual known contents. When a drum previously containing a hazardous material becomes empty, place an empty label on the drum. The empty drum is then moved to the empty drum accumulation point. When 20 to 30 drums accumulate, the supervisor fills out the appropriate form for disposal. If the drum previously contained an acutely hazardous waste as listed in 40 CFR or an extremely hazardous waste as listed in Title 22 CCR, then it is not an empty container and must be managed as hazardous waste.</p>
Disposal of Small Amounts of Hazardous Waste	<p>The container or bag must be labeled with a description of the material. A hazardous waste accumulation label must be affixed to the container and filled out completely and accurately. Fill out an appropriate form for disposal.</p>
Spill Procedures Emergency Response	<p>The area supervisor sets up emergency response supplies at major hazardous material storage and waste accumulation locations. The supervisor alerts all personnel of the probable spill routes and instructs them on the procedures to follow to prevent the spilled material from reaching the environment. If the spill cannot be contained and it takes more that 2 person-hours to clean up, the Duty Office and the Division Safety Office must be called immediately. Dial 9-1-1 if you cannot get an immediate response or if the spill is extreme and out of control.</p>
Spill Control	<p>The following steps are to be followed for any type of spill. Control a spill or leak only if it is possible to do so safely:</p> <ul style="list-style-type: none"> • Notify the area supervisor and the Division Safety Office immediately. The Division safety offices should notify the ARC Safety, Environmental and Mission Assurance Office. • Evacuate any affected personnel. • Secure the area. use safety tape, cones, barricades, etc., so the area is visible and inaccessible to all employees in the area. • Protect yourself. Before trying to identify or clean up the spill, determine what personal protection equipment is necessary. • Contain the spill. • Identify the spill through the use of visual and chemical means (color, odor, pH, viscosity).

Small Spill
Cleanup

Spill Cleanup of less than 2 person-hours of clean up time.

- Put on appropriate personal protection equipment (gloves, goggles, face shields, aprons, etc.)
- Use appropriate spill cleanup wipes, pads, or absorbent to contain and cleanup the spill.
- Put all spill material in a plastic bag, secure the bag, and place that bag in another bag. Secure the second bag.
- Attach a correctly completed hazardous waste label to the bag and place in the appropriate secondary containment storage area for disposal.

Large Spill
Cleanup

Spill Cleanup of more than 2 person-hours of clean up time.

- Call 9-1-1 to immediately notify the Duty Office. Also immediately notify the area supervisor and the Division Safety Office.
- Evacuate any affected personnel.
- Secure the area and try to prevent spill from going into any storm or sanitary sewer drains.

Hazardous
Waste
Regulations

EPA (40 CFR) and California Department of Health Services (Title 22 CCR) enforce specific regulations for hazardous wastes.

Hazardous
Materials
Regulations

Hazardous waste is also a hazardous material, therefore the following regulations apply:

Table 5-1: Hazardous Materials Regulations

Regulatory Agencies	Regulation(s)
Cities of Mountain View and Palo Alto	<ul style="list-style-type: none"> • Sanitary Sewer Ordinance
Santa Clara County Health Department, Toxic Substance Control	<ul style="list-style-type: none"> • Hazardous Materials Storage
California Regional Water Quality Control Board	<ul style="list-style-type: none"> • Title 23 CCR
California Office of Emergency Services	<ul style="list-style-type: none"> • Title 19 CCR
EPA	<ul style="list-style-type: none"> • Resource Conservation Recovery Act (RCRA) • SARA Title III • Clean Water Act

Table 5-1, Continued

Regulatory Agencies	Regulation(s)
OSHA	<ul style="list-style-type: none"> Hazard Communication Standard
Bay Area Air Quality Management District	<ul style="list-style-type: none"> Regulation 8, Rules 16, 19, and 29 Regulation 11, Rules 1 and 2

5.4. Training Requirements

Emergency Response Training

Personnel who handle hazardous substances require the following training:

- Hazard communications.
- Hazardous waste management.
- Environment essentials.
- Emergency procedures including the cleanup of spills and the disposal of broken containers..

Other Training

Other training includes:

- The use of proper handling equipment, protective apparel, and safety equipment.
- Dangers of contacting chemicals by skin absorption, inhalation, or ingestion.
- Labeling.
- Proper methods of substance handling and storage including the sensitivity of some substances to heat, moisture, light, and other storage hazards.
- Secondary containment requirements and disposal procedures.
- How to read and understand a MSDS and other details of the hazard communication program.
- Hazards associated with flammable liquids, toxic gases and vapors, and oxygen displacement.
- Substances that react with water and other hazards that can create hazardous conditions.
- Packages that exhibit evidence that the inside container has been broken and/or has leaked its contents.

Training
Responsibilities

Supervisors' training responsibilities include the following:

- To ensure that formal annual training is provided to employees.
- To attend a minimum of 4 hours training on hazardous materials and waste handling.
- To ensure employees are trained when a new chemical is being used or the process changes.
- To attend annual refresher courses.

5.5. Record-Keeping Requirements

Solvent-Use
and Coating
Operations

Certain permits, issued by the BAAQMD, impose operating conditions such as solvent-use record keeping. In many cases, permits for solvent-use sources require daily records. Record keeping is also required for coating operations. Check the specific conditions for the sources operated in you area.

5.6. Definitions

Extremely
Hazardous
Material

Legally defined by Superfund Amendments and Reauthorization Act (SARA) Title III as any chemical on the Chemical Emergency Preparedness Program (CEPP) list administered by the Environmental Protection Agency (EPA). The most recent list contains 360 chemicals (55 Federal Register 5544, Feb. 15, 1990; amending 40 CFR part 355, appendices A and B).

Hazardous
Material

Any material that represents a physical or health hazard or is hazardous to the environment. health hazards include carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, and agents that damage the lungs, skin, eyes, or mucous membranes. Detailed definitions are given in CFR title 29 part 1910.1200.

Hazardous
Waste

Legally defined by Title 40 Code of Federal Regulations (CFR) and Title 22 California Code of Regulations (CCR) as a waste material that has any of the following properties: ignitable, corrosive, toxic, reactive, bio-accumulating, or is listed in Title 40 CFR or Title 22 CCR as a hazardous waste.

End of Chapter

6. Lockout and Tagout

6.1. Description

Purpose	<p>It is Wind Tunnel Operations Division policy to eliminate or control the potential for injury or facility or equipment damage that could result from unexpected start-up of equipment or the release of stored energy. This policy is implemented through the use of effective hazardous energy-control procedures. This standard establishes requirements and processes to implement that policy.</p> <hr/>
Scope	<p>This standard applies to all employees, temporary workers, support contractor personnel, and subcontractor personnel working under the authority of the Wind Tunnel Operations Division. It applies to all maintenance activities where there is a potential for injury or damage due to the unexpected start-up of equipment or the release of stored energy. It also applies to all operations where personnel must remove or bypass machine guards or other safety devices, place any part of their body in contact with operating equipment, or place any part of their body into a danger zone associated with a machine operating cycle.</p> <p>The term “maintenance” as used herein, includes workplace activities such as constructing, installing, setting-up, adjusting, inspecting, modifying, maintaining, or servicing equipment.</p> <p>This standard does not apply to plug and cord supplied equipment where the plug is under the control of the person performing the maintenance, and the removal of the plug isolates all energy from the equipment.</p> <p>Any deviations from, or exceptions to, these requirements shall be approved in writing by the Wind Tunnel Operations Division Chief and the Support Contractor General Manager, or their designees, as appropriate.</p> <hr/>

6.2. Responsibilities

Managers	<p>Managers have the following lockout and tagging responsibilities:</p> <ul style="list-style-type: none">• Ensure that each affected and authorized employee understands the importance of following lockout and tagging procedures.• Take all necessary steps to enforce tagging requirements.• Designate logbook custodians. <hr/>
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Supervisors	<p>Supervisors have the following lockout and tagging responsibilities:</p> <ul style="list-style-type: none"> • Ensure each of their authorized and affected employees complete required lockout and tagging training. • Ensure that written energy-control procedures are developed for equipment under their authority as specified herein. • Monitor work to ensure compliance with energy-control requirements and procedures. • Ensure that an adequate supply of energy-isolation devices is available and provided to authorized employees. • Conduct visual observations of energy-control procedures. • Take actions to correct errors in procedures and failures of personnel to follow established procedures.
Facility Managers, Chief Engineers, and Service Managers	<p>Facility Managers, Chief Engineers, and Service Managers lockout and tagging responsibilities include coordinating with representatives of subcontractors or other NASA organizations to:</p> <ul style="list-style-type: none"> • Ensure the safety of Wind Tunnel Operations Division personnel. • Minimize the potential for adverse effects on operations. • Ensure the safety of equipment and facilities.
Logbook Custodians	<p>Logbook Custodians have the following lockout and tagging responsibilities:</p> <ul style="list-style-type: none"> • Inspect their assigned logbooks periodically to ensure that entries are being performed completely and correctly, document inspection findings on Safety Observation Reports, and discuss findings with employees or supervisors as appropriate. • Remove completed Energy Control Log Sheets, form SS17, from logbooks and retain them for a minimum period of six months.
Employees	<p>Employees have the following lockout and tagout program responsibilities:</p> <ul style="list-style-type: none"> • Perform their assigned work in accordance with their training, these requirements, and specific lockout and tagging procedures. • Assist supervision with the development and validation of lockout and tagging procedures. • Report identified errors or omissions in procedures to supervision so that appropriate corrective actions can be taken. • Remove Personal locks and Personal tags at the end of each shift and at other times when not available on site to remove them.

6. Lockout and Tagout

Division Safety Office	<p>The Division Safety Office responsibilities include the following:</p> <ul style="list-style-type: none">• Provide overall guidance for the hazardous energy-control program.• Revise and maintain these energy-control requirements.• Procure and issue personal and administrative locks, tags, and labels in accordance with these requirements.• Assist supervision in performing inspections as requested.• Maintain a repository for completed inspection checklists.• Assist with the validation of lockout and tagging procedures as requested.• Perform semi-annual reviews of written energy-control procedure inspection records to determine inspection requirements are being met. <hr/>
Subcontractors	<p>Subcontractors shall demonstrate that they have trained their employees in basic lockout and tagging requirements and procedures, and comply with the direction provided by Wind Tunnel Operation Division or Support Contractor when they must participate in activities addressed within the scope of these requirements</p> <hr/>
Authority	<p>All personnel are authorized to refuse to perform work when conditions or practices associated with an energy-control activity pose an imminent danger of injury or harm to personnel, facilities, equipment, or the environment.</p> <hr/>
Penalties	<p>The deliberate bypassing of tags or locks, unauthorized removal of tags or locks, the deliberate operation of tagged out or locked out equipment, failure to lock out or apply tags when required, and the failure to follow the requirements of this document are grounds for disciplinary action including discharge from employment.</p> <hr/>

6.3. Energy Control Requirements

General

Lockout procedures shall be employed as the preferred method of establishing a zero energy state and securing energy-isolation devices in a safe configuration before initiating maintenance.

Energy isolating devices are mechanical devices that physically prevent the transmission or release of energy. They include devices such as manually operated circuit breakers, power disconnect switches, in-line valves, physical blocks, blanking plates, and any similar devices used to block or isolate energy. **Push buttons, selector switches, interlock switches, and other control circuit type devices do not generally qualify as energy isolating devices.**

Tagging out an energy-isolation device only provides a warning to indicate that it (and the associated equipment) should not be operated as long as the tag is in place. Tagging does not provide the same level of security as lockout against intentional or inadvertent operation of energy-isolation devices therefore lockout devices shall always be used instead of tags when it is possible to do so.

Each individual performing work requiring the application of locks or tags for personal protection shall apply their own lock or tag to the energy-isolation or group lockout device. Employees may not work under the protection of locks or tags applied by others, nor may they allow others to perform work under the protection of their Personal lock or tag.

Persons desiring to inspect work in an area where personnel are being protected by lockout or tagging processes shall apply their own Personal lock and tag to the energy-isolation device before entering the protected area. Each individual shall remove their Personal lock and tag when exiting the protected area.

Locks and tags shall not be used to permanently secure equipment for which there is no planned future use. The use of locks and tags under these circumstances lessens the significance of all other locks and tag present in the workplace. To minimize the number of locks and tags present in the workplace for extended periods, when equipment is removed from service for a period exceeding 12 months, steps shall be taken to permanently isolate it from energy sources (i.e. decommission).

Equipment Design

Specifications for the purchase of new equipment shall include energy-isolation devices that can be locked.

Whenever equipment having energy-isolation devices that cannot be locked undergo major repair, modification, or renovation their energy-isolation devices shall either be altered to accept lockout devices or be replaced with devices that will accept a lockout device.

Equipment
Labeling

Each machine, system, or subsystem requiring a written energy-isolation procedure shall be marked with a black and yellow label as shown.

6.4. Lockout and Tagout Equipment

Tags

Tags serve as a warning against the operation of an energy-isolation device and the associated equipment. They DO NOT physically prevent operation of the energy-isolation device the way lockout devices do. Therefore, tags shall be used as the sole means of preventing the operation of energy-isolation devices only in instances where it is impossible to apply a lockout device.

“Danger Do Not Operate” (Hold-Off or Danger, ARC Form 316) tags shall be used in conjunction with all activities where there is a need to ensure personnel protection during maintenance activities. This applies whether the activity involves lockout or tagout. Three variations of these tags are used within Wind Tunnel Operations Division facilities: Personal, Master, and Referral danger tags. These tags serve to facilitate tracking of lockout events and to warn of danger to personnel.

Personal danger tags shall be applied to energy-isolation devices or group lockout devices by each individual performing a maintenance activity exposing themselves to hazards posed by the unexpected energizing of equipment or the release of stored energy. There are two types of Personal danger tags; those prepared for regular employees and those use by visitors. Regular employees, who have successfully completed lockout and tagging training, will receive laminated tags that contain their photograph, their name, and the name of their employer. Visitors receive laminated tags with spaces to write their name and the name of their employer.

Master danger tags are unmodified “Danger Do Not Operate” (ARC form 316) tags. Master danger tags serve to:

- Facilitate logging and tracking of lockout devices and tags.
 - Maintain the continuity of an energy-isolation configuration when a hazardous energy-control activity will extend beyond the end of the work shift of the employees who applied the lockout devices and tags.
 - Provide single work group control when multiple work groups will be locking or tagging the same energy-isolation device simultaneously to support different work activities.
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Referral tags are used reduce the administrative burden associated with creating logbook entries for hazardous energy-isolation activities that involve more than one energy-isolation device. They shall always be used in conjunction with a Master danger tag.

“Caution Special Conditions” tags, ARC form 317, shall be used solely in conjunction with the administrative or operational control of equipment. They SHALL NOT be used in situations where a violation of the lock or tag could result in injury to personnel who are performing maintenance. Caution tags are used to warn that equipment has been placed in, or must remain in, a specific operating condition. Caution tags shall be used with locks to prevent unauthorized use of equipment. These limitations may include prohibitions on any operation, requirements for remaining on at all times, reasons why equipment was taken out of service, or specific conditions under which the equipment may be operated.

General
Tagout
Requirements

Whenever tags must be used as the sole means (i.e. no locks) of preventing the operation of energy-isolation devices on equipment, additional means shall be used to ensure the same level of protection as the application of a lockout device. This is to be accomplished by using a second means of isolating the hazardous energy source from the equipment. The energy path shall be broken in at least two locations, with danger tags applied at both locations. Such means may include isolating another serial circuit element, blocking a controlling switch, opening an extra disconnecting device, or removing a valve handle.

All tag attachment methods shall be non-reusable, attachable by hand, self locking, resistant to the environmental conditions in which they will be placed (wet, corrosive, etc.), and have a minimum unlocking and breaking strength of 50 pounds. Nylon cable ties that are at least 3/16” wide meet these requirements, strings and cords do not.

Written procedures shall be developed for all energy-isolation activities where tags (rather than lockout devices) are used as the sole means of controlling an energy-isolating device. Written procedures are required since all exceptions to the requirements for written procedures apply only to machines that are capable of being locked-out.

Lockout
Devices

The only lockout devices that may be used for hazardous energy-control and administrative locking are those specifically issued by the employer (civil service or contractor) for that purpose. Lockout devices, including, locks, hasps, group lockout boxes, etc. can be obtained from the Support Contractor Safety Office.

Locks used at the Ames Research Center for personnel protection (Personal locks) shall be red in color. Locks manufactured by the American Lock Co. (such as model # 1106R) are the standard locks issued within the Wind Tunnel Operations Division. Locks used for administrative locking shall be a color other than red.

Personal locks were issued in a variety of colors before July 1999. The owners of these locks may continue to use them providing they apply a standard label to them that identifies them as locks being used for personnel protection (see example). The labels are available from the Support Contractor Safety Office.

Only one key will be issued for each Personal lock. Additional keys are destroyed at the time the lock is issued. Each lock used for personnel protection shall indicate the identity of the individual who applied it. This shall be accomplished in Wind Tunnel Operations Division facilities by attaching Personal danger tags to the locks. Locks identified by stamping owner's name may continue to be used when they are applied in conjunction with a Personal danger tag. The application of a single Personal lock and single Personal danger tag per individual is the minimum acceptable protection for those involved in a maintenance activity involving hazardous energy control.

Supervisor,
Equipment,
and
Administrative
Locks

Other types of locks used within the Wind Tunnel Operations Division include Supervisor, Equipment, and Administrative locks. Supervisor locks are gold in color and issued to supervisors, shift leaders, facility managers, facility chief engineers, etc. They are used to ensure the continuity of and energy-isolation configuration through shift change periods and to provide individual work group control when multiple work groups are concurrently using the same energy isolation devices to support different work activities. Individual locks may have multiple keys since these locks do not provide protection to individual workers.

Equipment locks are red in color and used in conjunction with Referral tags for hazardous energy-control activities involving the application of multiple energy-isolation devices. Each lock has a single key that is either retained by the individual who applied it or secured in a group lockbox for the duration of the work activity.

Administrative locks are a color other than red or gold and are used for purposes other than personal protection. Administrative locking applications include securing valves or switches in a specific position, preventing unauthorized use of equipment, securing areas, etc. A single lock may have many keys.

Temporary and
Visitor Locks
and Tags

Personal locks and danger tags may be issued to visitors on a temporary basis as long as authorized employees escort the visitors when entering a protected location. Groups of visitors may enter areas where energy-control protection is in effect without applying individual locks or tags, as long as an authorized employee who has affixed a Personal lock and Personal danger tag to the appropriate energy-isolation device(s) escorts them. The escort is responsible for ensuring that all visitors that they are accompanying have left the protected area before removing their lock or tag.

Visitors, including subcontractors, who are directly involved in maintenance activities and may be injured by the unexpected energizing or startup of equipment, or the release of stored energy, shall apply Personal locks and Personal danger tags to the appropriate energy-isolation device.

6.5. Application of Lockout and Tagging

Standard
Energy Control
Process

The process for isolating equipment from their energy sources and securing them in a safe configuration, and reactivating them following maintenance is described below. This process shall be incorporated into all written procedures and should be followed even when the work does not specifically require the use of a written procedure.

- Notify employees affected by equipment shutdown.
 - Identify types and magnitudes of energy.
 - Identify the hazards posed by the energy to be controlled.
 - Identify the methods and means to be used to control the energy.
 - Shutdown equipment.
 - Locate and position all of the required isolation devices to isolate energy from the equipment.
 - Apply locks and tags as required to secure the energy-isolating devices in their “safe” or “off” position.
 - Relieve, disconnect, or restrain sources of potentially hazardous stored energy.
 - Monitor and re-verify that equipment remains at a zero energy state when there is a possibility that energy may re-accumulate.
 - Verify that energy sources are isolated by operating equipment controls or by taking measurements of voltages, temperatures, pressures, etc.
-

Release from
Lockout and
Tagging

The following items are needed to release a machine or system from a locked out and tagged condition:

- Inspect the equipment to verify that tools, non-essential materials, and equipment are removed and that the equipment has been reassembled correctly.
 - Verify that personnel are clear of the potential hazards and notify all “affected personnel” of the impending removal of lockout devices and tags and equipment reactivation.
 - Remove lockout device(s) and tag(s).
 - Reactivate equipment.
 - Test and verify that equipment is functioning properly.
-

6.6. Written Energy Control (Lockout and Tagging) Procedures

Circumstances
Requiring
Energy Control
Procedures

Written lockout procedures shall be developed as needed and retained to support future work activities. An electronic template of a generic Hazardous Energy Control Procedure is available from the Wind Tunnel Operations Division’s Document website. Written energy-control procedures shall be developed whenever any of the following conditions exist:

- The maintenance of equipment could create hazards for employees who are not directly involved in maintenance activities.
 - There is a single energy source, but it is difficult for the employee to identify and isolate due to its location or configuration.
 - There is a potential for injury or damage due to the release of stored energy, residual energy, or the re-accumulation of stored energy after shutdown.
 - It is necessary to rely on tags (no locks) as the exclusive means of keeping energy-isolation devices in a safe configuration.
 - It is necessary to use more than one lockout device to make a piece of equipment, machine, or system safe to work on.
 - There is more than one source of energy (normal and backup electrical, pneumatic, hydraulic, gravity, thermal, chemical, etc.) for the equipment that will be undergoing maintenance.
 - There have been past accidents involving the unexpected activation of the equipment or release of stored energy during past maintenance activities.
-

Worksheet
Requirements

When preparing the Hazardous Energy Control Procedure Development Worksheet, form SS14; it is essential that complete information be provided. When completing a worksheet for a specific system or equipment, provide the following information to ensure the final procedure meets all requirements.

- Identify affected employees and provide for their notification prior to energy-isolation activities.
- Identify energy types and amount.
- Identify the hazard associated with each energy type present.
- Identify methods and equipment used to isolate and control energy.
- Identify proper shutdown procedures.
- Specify the type, location, and positioning of all required energy-isolation devices.
- Indicate the correct valve, switch, and breaker positions needed for safe energy isolation.
- Indicate specifically where locks and tags must be placed.
- Indicate, step by step, how to safely relieve, disconnect, or restrain sources of potentially hazardous stored energy.
- Identify any potential for energy to accumulate and, step by step, how to monitor, remove, or verify continued safe working conditions.
- Identify, step by step, method for testing or verifying the proper isolation of hazardous energy.
- Provide steps to ensure maintenance related tools and equipment are removed and equipment is properly reassembled prior to restoring energy sources.
- Provide for the notification of affected employees prior to restoration of energy sources.
- Provide, step by step, method to verify proper operation of equipment following maintenance.

Creating New
Written Energy
Control
Procedures

An individual or group of individuals may develop written energy-control procedures. A group may be required to develop procedures for complex equipment or lockout and tagging situations. At least one “Authorized Employee” who is familiar with the equipment being isolated shall participate in procedure development. A draft procedure worksheet, form SS14, shall be peer reviewed and approved by an “Authorized Employee” supervisor who is familiar with the equipment being isolated.

Use the following steps to develop a new energy-control procedure:

Step	Action
1	Obtain a copy of the “Hazardous Energy Control Procedure Development Worksheet”, form SS14 from the Wind Tunnel Operations Division Document web site or from a supervisor.
2	Using equipment knowledge, manufacturer’s instruction manuals, engineering drawings, etc. record the information requested on the worksheet.
3	Provide the completed worksheet to the appropriate supervisor.
4	Designated person(s) perform a review of completed procedure worksheet for completeness, accuracy, and safety.
	<p style="text-align: center;">NOTE</p> <p>Supervisors who are “Authorized Employees” and knowledgeable of the equipment being isolated may perform a peer review of the procedure worksheet. Supervisors may choose to assign the peer review to another “Authorized Employee” who is familiar with the equipment being isolated</p>
5	The supervisor signs and dates the completed worksheet and forwards to the Technical Publications Group for assignment of a control number, final procedure formatting, and posting to the appropriate document website.
	<p style="text-align: center;">NOTE</p> <p>Once approved by the supervisor, the worksheet can be used as the procedure until the final formatted version becomes available on the document website.</p>

Revising
Written Energy
Control
Procedures

Completed energy-control procedures are controlled documents. The supervisor or “Authorized Employee” initiating a change shall follow the document change process contained in the Wind Tunnel Operations Division Configuration Management Procedures, A027-9391-XB4.

6.7. Lockout Device and Tag Monitoring

Description

All energy-isolation activities requiring the application of a Master danger tag shall be logged and tracked. Master danger tags shall be applied whenever:

- The hazardous energy-control activity will extend beyond the end of the work shift of the authorized employees who applied the locks and tags.
- The hazardous energy-control activity requires the application of locks or tags to more than one energy-isolation device.
- Multiple work groups will be locking or tagging the same energy-isolation devices simultaneously to support different work activities.

In all other instances, authorized employees may rely solely on the application of Personal locks and Personal danger tags without the need for logging and tracking.

Tracking is accomplished by removing the stub portion of the Master danger tag and recording information about the lockout or tagging activity into the appropriate facility or system Hazardous Energy Control Logbook. An electronic copy of the log sheet, form SS17, is available on the Wind Tunnel Operations Division Document website.

Logbook custodians shall be designated and identified in each logbook. The custodians shall periodically inspect their logbooks for accuracy and completeness and shall ensure that pages containing documentation of lockout or tagging activities are retained for a six-month period following completion of the lockout or tagging activities they are associated with.

Applying and Removing Tags

When lockout device and tag monitoring is required, follow these steps for applying or removing lockout devices and tags:

Step	Action
1	Fill-in the required information on the Master danger tag and stub at the time of application.
2	Make an entry for the tag on a Hazardous Energy Control Log Sheet in the appropriate facility or system logbook.
3	Attach the tag stub to the portion of the page where the logbook entry was made.
4	Perform the lockout or tagging activity in accordance with the appropriate procedure.
5	Upon completion of the maintenance activity, remove the lockout devices and tags in accordance with the appropriate procedures.

Step	Action
6	Complete the Master danger tag by entering the required “Reported Clear” and “Put in Service” information and sign the tag.
7	Complete the logbook entry by filling in the “Cleared By” and “Placed in Service By” fields on the Energy Control Log Sheet in the appropriate facility or system logbook.
8	Fasten the removed tag to the corresponding stub and logbook entry for retention.

6.8. Multiple Shift Lockout and Tagout

Description

This section describes the process for ensuring continuity of energy isolation through shift-change periods and allows the energy-isolation configuration to remain in place for extended periods when personnel are not performing maintenance activities. This process does not require shift overlap to ensure continuity of protection; however, departing and arriving supervisors or designated leads shall exchange information about the progress of the work and the status of the equipment.

Follow these steps when energy isolation will remain in place longer than a single shift:

Step	Action
1	Follow established lockout or tagging procedure to prepare the equipment for shutdown and energy isolation.
2	Prepare a Master danger tag and make a logbook entry for the tag and work activity.
3	Initiate shutdown and isolation in accordance with the established procedure.
4	Apply a group lock hasp to the energy-isolation device.
5	Apply the Master danger tag and Supervisor lock to the group lock hasp.
6	Apply a Personal lock with Personal danger tag to the multiple lock hasp then perform the assigned tasks.
7	At the end of the shift, remove the Personal lock with Personal danger tag from the group lock hasp, leaving the Master danger tag and Supervisor lock in place to maintain the energy isolation.

Step	Action
8	Before beginning work on subsequent shifts while the lockout and tagging activity is still in progress, verify that the Master danger tag and Supervisor lock are still in place and that the equipment is in the correct energy-isolation configuration.
9	Apply your Personal lock with Personal danger tag to the multiple lock hasp and continue the work.
10	When work is complete remove your Personal lock with Personal danger tag and the Master danger tag and Supervisor lock. Then restore the system to operational status in accordance with the established procedure.
	<p style="text-align: center;">NOTE</p> <p>If the individual who completed the work did not apply the Supervisor lock and Master danger tag they shall leave them in place and contact the individual who did apply them. If the individual who applied them is not available, contact Shift Leader or Supervisor to have them removed.</p>

6.9. Group Energy Isolation Procedure

Description

Group lockout devices shall be used to allow each member of a group to exercise direct control of an energy-isolation device by applying their own Personal lock and Personal Danger tag to the Group lockout device. Master danger tags and Supervisor locks shall be used to provide individual work group control when multiple work groups are locking out or tagging the same energy-isolation device to support simultaneous work activities.

When tagging procedures are used because locks cannot be attached to the energy-isolation device, each individual in the group shall apply and remove their Personal danger tag in the same manner they would a lock.

Group Energy-
Isolation
Process

Follow these steps for group energy-isolation situations:

Step	Action
1	Use the established procedure to prepare for equipment shut down and energy isolation.
2	When the work involves multiple groups performing different functions on the same equipment, the lead or supervisor for each work group prepares their own Master danger tag, makes their log entry for the tag, and coordinates with others to initiate isolation and shutdown in accordance with the established procedure.
3	When a single device is used for energy isolation, each lead or supervisor applies a multiple lock hasp to the energy-isolation device for their group then applies a Master danger tag and Supervisor lock to their hasp.
4	When multiple lock hasps cannot accommodate the number of crews or crew members, or when locks must be applied to multiple energy-isolation devices, use Equipment locks and the Referral danger tag process to isolate energy sources and log the work activity. The leads or supervisor place the keys for the Equipment locks in a group lock box, and secure them by applying Master danger tags and Supervisor locks for their individual work activities.
5	Crewmembers attach their Personal locks and Personal danger tags to the appropriate group lockout device containing the Master danger tag and Supervisor lock for their work group.
6	Crewmembers remove their Personal locks and Personal danger tags at the end of the shift while leaving the Master danger tag and Supervisor lock in place.
7	When work is complete, each crewmember removes their Personal lock and Personal danger tag from the group lockout device.
8	Following the established procedure, the lead or supervisor removes the Supervisor lock and Master danger tag from the group lockout device and gives direction to restore the equipment to operational status.

6.10. Referral Tags

Description

The Referral tag process simplifies Hazardous Energy Control Logbook (logbook) documentation when it is necessary to lockout or tag multiple pieces of equipment to support a work activity. The process allows for the entry of a single Master danger tag in the logbook. The Master danger tag is then “referred to” by Referral danger tags that are applied to individual energy-isolation devices that are often remotely located, and support the same hazardous energy-control activity.

Using Referral Tags

When required, follow these steps to use the referral tag process:

Step	Action
1	The authorized employee determines from the written energy-control procedure that the hazardous energy-control activity will involve multiple energy-isolation devices.
2	The authorized employee prepares a Master danger tag for application to either a group lockout device or the primary energy-isolation device, and makes a corresponding entry in the appropriate logbook.
3	The authorized employee prepares Referral danger tags for application to each of the remaining isolation devices used to support the energy-isolation activity. The serial numbers and locations of each referral tag shall be included in the log entry for the Master danger tag prepared in the previous step.
4	The authorized employee follows the written energy-control procedure to apply the Master and Referral danger tags to each energy-isolation device involved in the hazardous energy-control activity. Referral danger tags shall be applied using equipment locks unless tagging procedures are being followed. The locks and tags remain in place for the duration of the work.
	<p style="text-align: center;">NOTE</p> <p>When the activity involves a single employee and a single work shift, the Master and Personal danger tags may be applied with a Personal lock. In all other situations, the Master danger tag shall be applied with a Supervisor lock.</p>
5	Following completion of the task, the authorized employee follows the written energy-control procedure to remove the lockout devices or tags, account for all Referral danger tags and equipment locks, complete the logbook entry, and reactivate the equipment.

6.11. Emergency Lockout Device or Tag Removal Procedure

Description

There is an increased risk of personnel injury and equipment or facility damage whenever someone other than the individual who applied them removes lockout devices or tags. Therefore, this special procedure shall only be performed under EXTREME circumstances. There is increased risk because the individual who applied the lockout device or tag may still be exposed to the hazard or may return to the workplace and resume work under the assumption that their device is still in place. There is increased risk of equipment or facility damage because the individual, who applied the device and has the most knowledge of the reasons for the application of the device and the operational status of the equipment, is not available.

This section defines the process for ensuring personnel safety and the safe configuration of equipment prior to authorizing removal of a lockout device or tag applied by an individual who is not present in the workplace when there is a need to remove energy-isolation. This procedure also applies to the removal of locks by their owners when the key has been lost. The need for applying this procedure should be very infrequent since personnel are required to remove their Personal locks and Personal danger tags from equipment at the end of each shift. The need for applying this procedure should also be reduced by the use of Supervisor locks for group, multiple isolation devices, and multiple shift activities.

When the individual who applied a lockout device cannot remove it because they do not have the key with them or because the key is lost, a master or duplicate key shall not be used to remove it. The lock shall be removed using bolt cutters or another method that results in the destruction of the lock. This prevents unauthorized removal of the lock by someone else if they find the key later.

In the case of lost keys, only the individual who applied them or his or her supervisor shall remove the lockout devices and tags. The “Emergency Lockout Device and Tag Removal Procedure” shall be followed when it has been determined that:

- A lockout device or tag applied for hazardous energy-control purposes is impeding progress on some critical activity.
- The authorized employee who applied the lockout device or tag is not available in the workplace to remove it or does not have their key.
- It is not possible to wait for the device owner to obtain their key or return to the workplace due to safety issues or the potential for significant operational impact.

**Removal
Procedure**

Lockout devices or tags shall not be removed until the requestor obtains the required approvals. During off-shift hours, when the responsible manager is not available in the workplace, the responsible manager may give removal approval by telephone; however, he or she must sign the removal request form immediately upon returning to the workplace. Follow these steps to perform the emergency lock removal procedure:

Step	Action
1	Fill out a Lockout Device and Tag Removal Request form, SS16.
2	When the form is filled-in and the required approvals have been obtained, proceed with the device removal in accordance with the applicable hazardous energy-control procedure.
3	Following device removal, return the completed form and removed devices to the device owner's supervisor.
4	The supervisor ensures that the device owner is informed of the device removal upon their return to work, before they are allowed to perform their normal work activities.
5	The device owner acknowledges the notification by providing a signature, and the date and time notified they were notified in the spaces provided on the form.
6	The supervisor forwards the completed form to the Support Contractor Safety Office for retention.

6.12. Lockout Processes Involving Interlock Keys

Description

The purpose for Interlock Keys is to control equipment configuration, and operation of wind tunnels and wind tunnel support systems. As such, they are part of the normal operating controls for these systems and DO NOT qualify as energy-isolation devices. Dependence on their exclusive use does not provide positive isolation from energy sources, since the energy paths may not be broken and secured by the Interlock Key.

Lockout procedures involving the use of Interlock Keys shall ensure that energy sources are isolated, locked out, and tagged to prevent unexpected energization or startup of equipment, or the release of stored energy during maintenance activities. If necessary, breakers may have to be racked out and the breaker room locked as well to assure zero energy state to the system, sub-system, or component undergoing maintenance.

Both the Wind Tunnel Operations Division and Support Contractor Safety Office personnel shall review lockout procedures involving Interlock Keys

6.13. Locking or Tagging for Administrative Purposes

Description

The purpose of administrative locking or tagging is to secure areas and equipment for operational or general safety and operational purposes. Administrative locks shall be a color other than red or gold. Administrative locks and tags shall not be used in situations where personnel performing maintenance may be exposed to hazards posed by the unexpected energization of startup of equipment or the release of stored energy. Personal Danger tags and Personal locks shall not be used for Administrative locking or tagging purposes. Administrative locks and tags may be used to:

- Secure unsafe equipment to prevent personnel injury, equipment damage, or facility damage.
- Secure equipment to prevent its operation by unqualified or unauthorized personnel.
- Secure equipment in a specific configuration such as locking fire suppression water valves open.
- Secure equipment that is no longer being used or maintained in a deenergized configuration.
- Secure doors and perimeter fences.

Before applying Administrative locks or tags, determine whether there is a need for hazardous energy control rather than Administrative locking or tagging. The requirements for hazardous energy-control locking and tagging shall be followed whenever there is a potential for the unexpected energization or startup of equipment or the release of stored energy to injure personnel performing maintenance.

Administrative locks and tags shall not be used to permanently secure equipment for which there is no planned use for more than 12 months. Permanently isolate such equipment from energy sources (decommission) to minimize the number of locks and tags present in the workplace for extended periods.

Administrative locks may have multiple keys. For example, multiple personnel may have keys for a lock applied to prevent the unauthorized use of equipment.

Administrative Danger Tags

“Danger-Do Not Operate” (ARC form 316) tags may be used for Administrative tagging purposes. Danger tags shall only be used in situations where equipment must be held in the OFF (deenergized) configuration to eliminate the potential for injury of personnel in the area or damage to the equipment or facility.

Administrative
Caution Tags

“Caution-Special Conditions” (ARC form 317) tags may be applied to equipment to identify operational limits or points of contact that can authorize its use.

Administrative
Lock and Tag
Monitoring

All Danger tags applied for Administrative purposes shall be entered into the appropriate Hazardous Energy-Control logbook in the same manner as a Master danger tag. The need to monitor Caution tags is determined for each tag use. Determining factors include the need to document the use restrictions and the need to communicate the restrictions to other prospective users.

6.14. Periodic Energy Control Procedure Inspections

Description

The use of individual written energy-control procedures shall be inspected each time they are used to determine:

- Whether the procedures are being followed as prescribed.
- Whether those involved in carrying out a procedure know their responsibilities.
- Whether a procedure continues to provide the necessary protection.
- Whether changes are necessary to increase a procedure’s effectiveness or to reflect new equipment conditions.

An authorized employee, who is familiar with, but not participating in, the current energy-control activity, shall perform the inspection. A place is provided at the end of each written procedure for the inspector to record his or her inspection results. Corrective actions shall be initiated for any observation that identifies deviations from or inadequacies in the procedure. The inspector shall verify that the procedure:

- Identifies current “Affected Employees”.
- Identifies current energy hazards available to equipment.
- Identifies all current energy-isolating devices.

The inspector shall also verify:

- “Authorized Employees” performed the procedure.
- The procedure was performed as written.
- Proper Master and Referral tag log entries were made.
- Lockout devices and tags were applied correctly.
- If required, personal protective equipment was properly used.

The final portion of each procedure contains the space for the inspector to record his or her observations and comments. When signed and dated, the completed procedure then becomes the inspection record and shall be delivered to the Support Contractor Safety Office for retention. The Support Contractor Safety Office will perform semi-annual reviews of the inspection records to identify common written procedure problems and any deficiencies in their proper completion.

6.15. Training

Description

All Wind Tunnel Operations Division employees require some level of hazardous energy-control training since virtually anyone may have occasion to enter an area where lockout devices and tags are in place. The content of the initial training varies for Authorized Employees, Affected Employees, and All Other Employees.

Authorized Employees

Initial Classroom training for Authorized Employees shall include:

- The content of this standard.
 - The purpose, function, and restrictions of the energy-control program.
 - Recognition of applicable hazardous energy sources.
 - Details about the type and magnitude of the hazardous energy sources present in the workplace.
 - The methods and means necessary to isolate and control energy source, i.e. the elements of the energy-control procedures.
 - Limitations of tags when they are used as the exclusive means of energy isolation.
-

Affected and Other Employees

Initial training for Affected Employees and Other Employees shall include:

- The contents of this standard.
- The purpose, function, and restrictions of the energy-control program and that only authorized employees possess the knowledge and skills necessary for the safe application, use, and removal of energy controls.
- Recognition of situations where energy-control procedures are being used.

6. Lockout and Tagout

- The purpose of written energy-control procedures and the importance of not attempting to start up or use the equipment that has been locked out or tagged.
 - Limitations of tags when they are used as the exclusive means of energy isolation.
-

Refresher Training

Refresher Training shall be provided to authorized employees and affected employees on an annual basis. The purpose of this retraining is to briefly acquaint them with the general requirements of the Hazardous Energy-Control Program, to communicate lessons learned, and to ensure that they are provided with the opportunity voice any questions or concerns they have with the Hazardous Energy-Control Program.

Additional refresher training will be performed whenever:

- There is a change in job assignments.
 - A change in equipment or processes that present new hazards.
 - A change in energy-control procedures.
 - A periodic inspection of an energy-control procedure reveals reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy-control procedure.
-

On the Job Training

Employees shall receive facility-specific training in the safe application, use, and removal of energy controls before being authorized to proceed unsupervised. Supervisors shall document the “authorization” to perform the application, use and removal of energy controls for individual facilities on an On-the-Job Training Record, form SS13. Completed forms shall be forwarded to the Support Contractor Safety Office for retention.

6.16. Subcontractors and Other Organizations

Description	<p>Employees of subcontractors and other organizations shall be provided with the same level of protection against injury as Wind Tunnel Operations Division, support contractor, and visitor personnel. Personnel who will perform work requiring hazardous energy control must be trained and qualified as “authorized workers” or be escorted by someone who is. In addition, steps shall be taken to coordinate work activities between subcontractors, representatives of other organizations, and points of contact for the Wind Tunnel Operations Division personnel. This coordination is critical to ensuring the safety of Division personnel, minimizing adverse effects on operations, and ensuring the safety of equipment and facilities. The appropriate points of contact are the Facility Manager, Facility Chief Engineer, or Facility Service Manager as appropriate for the specific work location.</p>
Other Organizations	<p>Other organizations control many of the utilities that support Wind Tunnel Operations Division facilities. Examples of these include electrical power, sanitary and fire suppression water, steam boiler and chiller systems, the sanitary sewer, etc. When these personnel perform maintenance activities in Division facilities, precautions shall be take to prevent the injury of “affected” personnel or damage to equipment or facilities. When necessary, Supervisor locks, Master danger tags, Personal locks, and/or Personal tags shall be applied by Division personnel to energy-isolation devices used by subcontractors or other organizations.</p>
Subcontractors	<p>When subcontractor services are required to support construction or maintenance in Wind Tunnel Operations Division facilities, the contracting organization shall inform the subcontractor of energy-control requirements and procedures. This may be done through appendices to contract documents. The subcontractor shall be required to follow these procedures unless they receive specific written authorization to follow other acceptable procedures. The criteria for determining whether subcontractors may follow other energy-control procedures are:</p> <ul style="list-style-type: none"> • Determining that only the subcontractor’s personnel will be exposed to, or affected by, hazards posed by the work activity. • Determining that the subcontractor’s energy-control program meets the Ames Research Center hazardous energy-control requirements and applicable regulations. • Demonstrating that the subcontractor personnel are trained in, and have knowledge of, the application of their energy-control program. • Making appropriate written procedures available as required.

Subcontractors that do not meet these criteria shall be treated in the same manner as escorted visitors who are exposed to the same hazards.

6.17. Definitions

Affected Employees	Employees whose job requires them to operate or use equipment on which maintenance may be performed using lockout or tagging procedures, or whose job requires them to work in an area where such maintenance is being performed.
All Other Employees	Employees whose job assignments are or may be performed in areas where energy control procedures are utilized.
Authorized Employees	A person who through classroom and on-the-job training is qualified and authorized to lockout or tag equipment in order to protect personnel during maintenance activities.
Capable of being Locked Out	The equipment has an energy-isolating device with a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy-isolating devices are capable of being locked out, if lockout can be achieved through the temporary application of lock hasps or other means of attaching locks, without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy-control capability.
Danger Zone	A portion of the operating zone of a machine where moving parts or released energy may cause injury to personnel.
Device Owner	The individual who applied the lockout device or tag.
Energized	Connected to an energy source or containing residual or stored energy. Consider electricity, pneumatic and hydraulic pressure, chemical, mechanical, gravity, springs, and etc.
Energy Control	Prevention of the unexpected energizing of equipment and the unexpected release of stored energy in equipment.
Energy-Control Procedure	A written procedure used by an authorized employee to orderly shutdown equipment, safely isolate and lockout or tag the energy sources, render safe all stored or residual energy, and verify the isolation and de-energization of equipment.
Energy-Isolating Device	A mechanical device that physically prevents the transmission or release of energy, such as a manually operated electrical circuit breaker, a disconnect switch, a line valve, a block, blanking plate, and any similar device used to block or isolate energy. Push buttons, selector switches, and other control circuit type devices are not energy isolating devices.

Imminent Danger	Any conditions or practices that pose a danger which could reasonably be expected to cause death or serious physical harm, serious damage to facilities or equipment, or serious damage to the environment, either immediately or before the danger can be eliminated through normal procedures and processes.
Interlock Key	An operational control used to establish and maintain the configuration of wind tunnel equipment, sub-systems, and systems.
Lockout	The placement of a “lockout device” on an energy-isolating device, in accordance with an established procedure, ensuring that the energy-isolating device and the equipment being controlled cannot be operated until the “lockout device” is removed.
Lockout Device	A device that utilizes a positive means such as a lock to hold an energy-isolating device in the safe position and prevent the energizing of equipment. Blank flanges and bolted slip blinds are considered to be lockout devices for the purpose of this standard.
Maintenance	Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining or servicing equipment. These activities include lubrication, cleaning or unjamming of equipment and making adjustments or tool changes.
Master Danger Tag	A danger tag that is recorded in a Hazardous Energy Control Logbook. Master danger tags are used in conjunction with all multiple work shifts, multiple groups, and multiple isolation device lockout and tagging activities. They are also used in conjunction with all single group lockout or tagging activities except those involving: a single group and a single isolation device and a single work shift.
Normal Operations	The utilization of equipment to perform its intended function.
Personal Danger Tag	A danger tag that is issued to an authorized employee for their personal protection. The tag contains their photograph, name, and company affiliation. The authorized employee shall apply the tag whenever they are involved in maintenance activities requiring hazardous energy control and they are in a location where the unexpected energization or startup of equipment could injure them, or release of stored energy. Visitor danger tags are temporary Personal danger tags issued to wind tunnel visitors. Visitor danger tags retain the user’s name and company affiliation but do not contain a photograph.
Point of Operation	The point at which an individual comes into contact with a machine for the purposes of operating the machine for its intended function.

Referral Danger Tag	A danger tag used in conjunction with, and references, a Master danger tag and Hazardous Energy Control Logbook entry, in situations where a single hazardous energy-control activity involves multiple energy-isolation devices.
Setting Up	Any work performed to prepare equipment to perform its intended function.
Subcontractors	Individuals or organizations with who contracts are issued for services either directly by the Wind Tunnel Operations Division, or by the Support Contractor on behalf of the Wind Tunnel Operations Division.
Support Contractor	The company holding the Wind Tunnel Operations Division's Aerospace Testing Facility Operation and Maintenance contract.
Tagout	The placement of a tag on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not be operated until the tag is removed.
Verify and Verification	Actuating the controls that are normally used to energize and operate the equipment on which maintenance will be performed to confirm that it has been isolated from the energy sources.

6.18. Locking and Tagging Examples

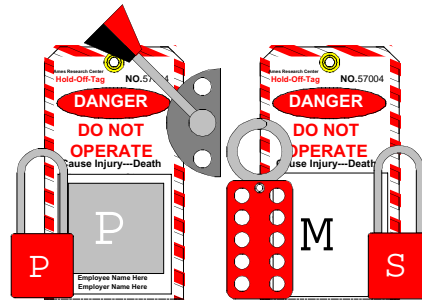
Description	The following pages show examples of the various ways locks and tags shall be used. The examples show most of the locking and tagging situations normally encountered within the Wind Tunnel Operations Division.
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6. Lockout and Tagout

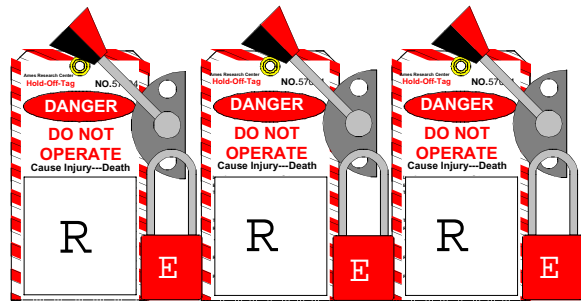
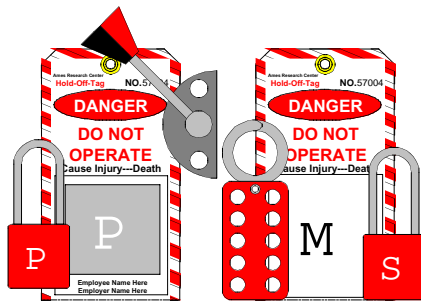
Single Person, Single Shift, Single Device



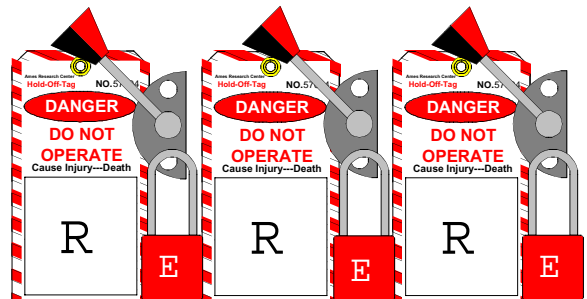
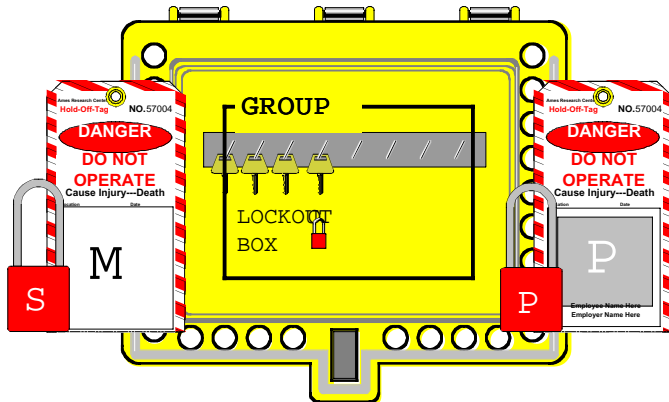
Single Person, Multiple Shifts, Single Device



Single Person - Single Shift - Multiple Devices

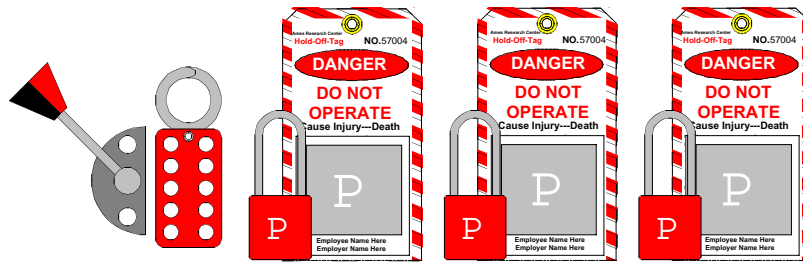


Single Person - Multiple Shifts - Multiple Devices



6. Lockout and Tagout

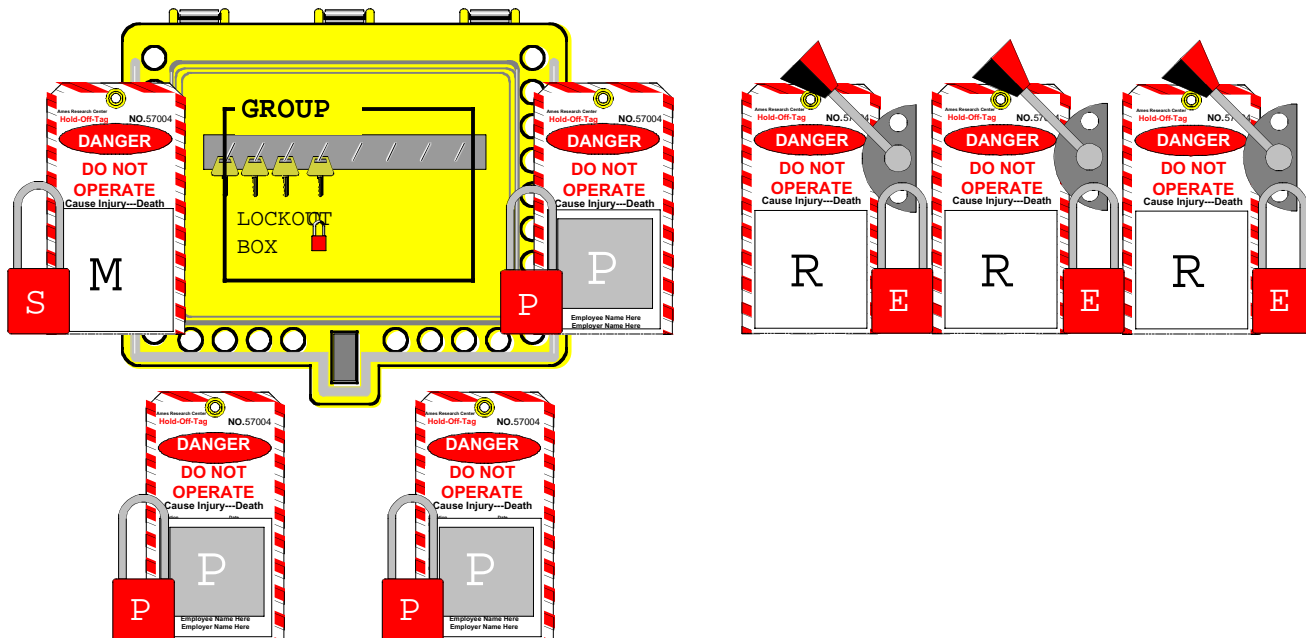
Single Group - Single Shift - Single Device



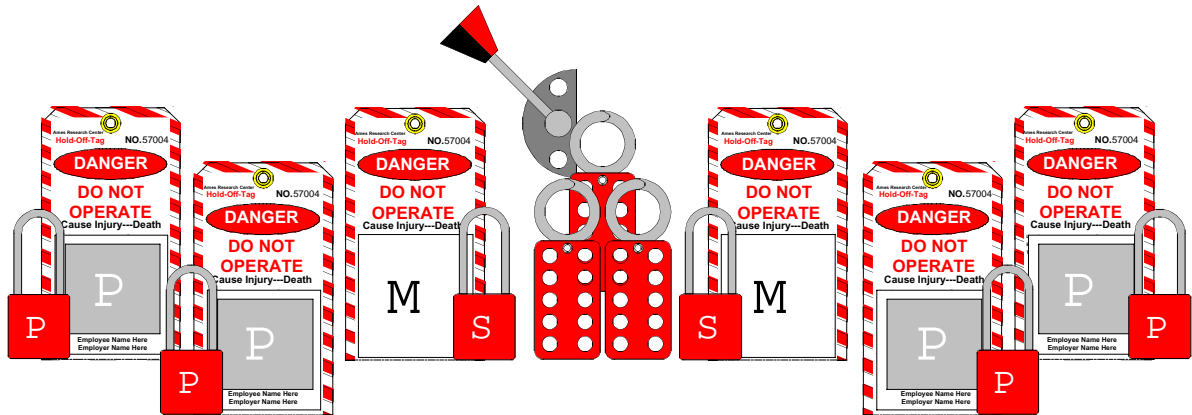
Single Group - Multiple Shifts - Single Device



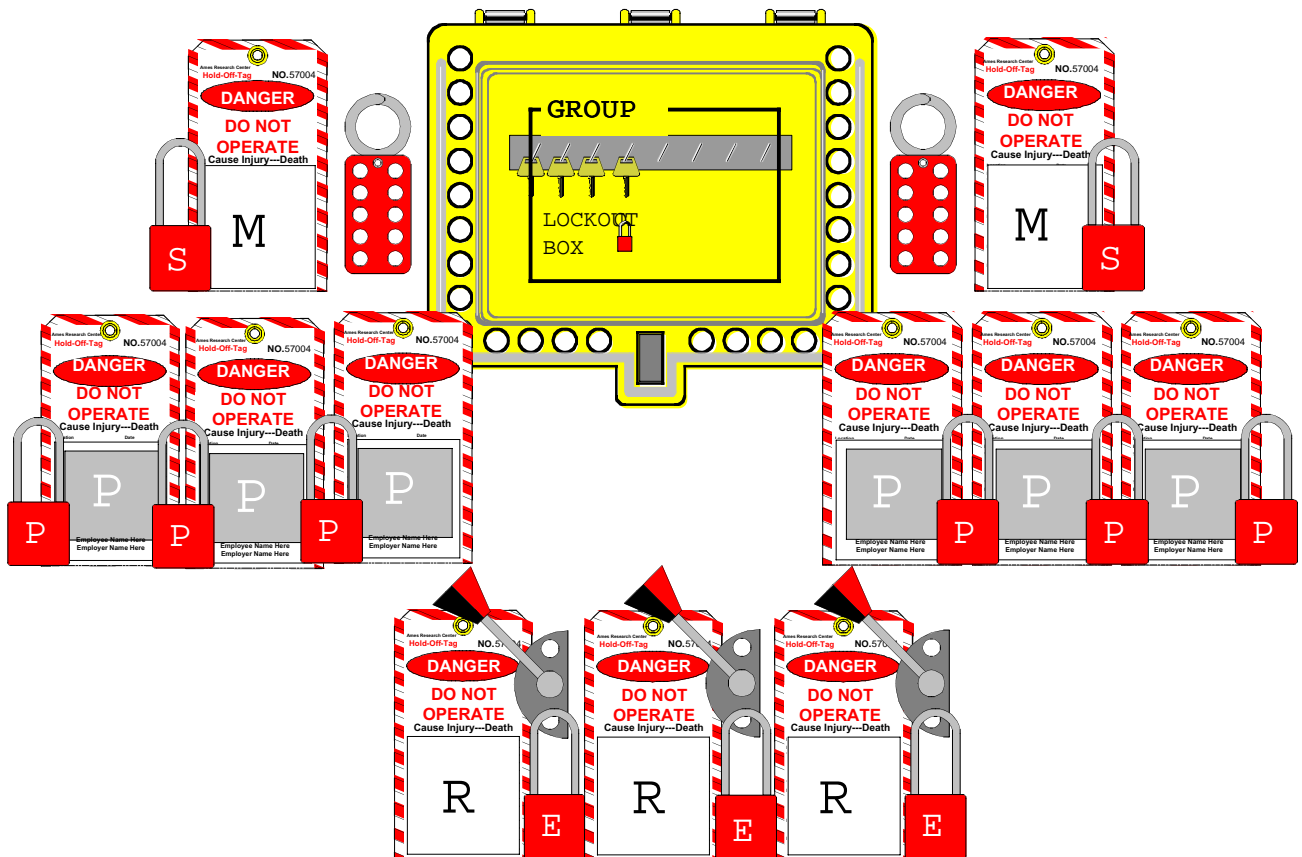
Single Group - Single/Multiple Shift - Multiple Devices



Multiple Groups - Single/Multiple Shift - Single Device

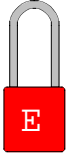
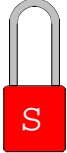
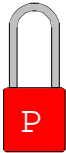


IX. Multiple Group - Single/Multiple Shift - Multiple Devices






Symbol Key

Lock Types



PersonalSupervisorEquipment

Tag Types



PersonalMasterReferral

End of Chapter

7. Radiography Safety

7.1. Description

Purpose	<p>This purpose of this plan is to assure compliance with the safety provisions of the Health and Safety Manual, Ames Research Center, AHB 1700.1, for activities associated with radiography inspection of Wind Tunnel Operations Division facilities and equipment. It is the Division's policy that no one is required to work in an area where exposure at any time could exceed the levels allowable for continuous or instantaneous exposure.</p> <p>Radiography activities should be performed at times when a minimum number of persons are present (off-shift and weekends). No set-up is allowed before 5:00pm for activities conducted during the week. Radiography requires the following:</p> <ul style="list-style-type: none">• Certification (as part of radiographic safety plan).• Completion of area control precautions.• Appropriate personnel notification (to Duty Office, Safety Office, Code JE, Code JEF, Wind Tunnel Operations Division personnel, etc).• Briefing of radiographic inspectors on fire safety requirements.
Scope	<p>This manual applies to Division civil servant and support contractor personnel, subcontractors, temporary workers, and visitors under the authority of the Wind Tunnel Operations Division.</p>

7.2. Responsibilities

Single Point of Contact	<p>Radiographic inspections require a Single Point of Contact (SPC) to coordinate radiographic activities within areas under the control of the Division. The Division Chief who serves as the SPC until an SPC is designated, must designate the SPC in writing on a Single Point of Contact form, RSP1. The SPC has the authority to delegate tasks and responsibilities to the Project Manager, and is mainly responsible for the following:</p> <ul style="list-style-type: none">• Preparing a Radiography Procedures and Radiation Safety Plan for each activity to be signed by the Division Chief and maintenance and operations branch chiefs.• Maintaining familiarity with the provisions of the Ames Radiation Safety Guide in the Ames Health and Safety Manual, AHB 1700.1.• Coordinating with operations branch, support services contractor(s), and other organizations.• Inspecting area control provisions and ensuring signs identifying activity and times are posted.
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7. Radiography Safety

- Ensuring that the persons performing the radiographic inspection have been briefed on fire safety requirements.
 - Advising line management on the status of the radiographic activity and notifying management in writing of the planned activities including: location, area control provisions, who is performing the work, when the work will be performed, and when areas are to be cleared.
 - Notifying the Ames Radiation Safety Officer (RSO) 72 hours before the start of radiographic activities.
-

Radiation Safety Officer (RSO)

The RSO's responsibilities include the following:

- Reviewing and retaining file copies of the radiography contractor's safety plan, NRC license, and reciprocity agreement.
 - Meeting with the Project Manager to evaluate the safety plan, location of radiography, source activity, schedule of operation, and notification plan, and providing guidance to project personnel
 - Issuing NASA, Ames radiation film badges to Ames personnel to document any on-site exposure (industry contractors are responsible for providing their own film badges).
 - Auditing radiography operations and suspending radiography activities if warranted by safety deficiencies.
 - Reviewing and concurring with this Radiography Safety Plan and specific project radiography plans.
 - Informing Nuclear Regulatory Commission (NRC) when new radiographers have received contracts to operate at NASA, Ames (within the past year).
-

Project Managers

Project managers' responsibilities include the following:

- Keeping the RSO informed on radiographic activities. Assuring that the radiography contractor has a safety plan and a license or reciprocity agreement on file with the RSO.
- Notifying NASA facility safety representatives and management in the restricted radiography testing area to assure that any disruptions to their operations are understood.
- Notifying NASA security and the Moffett Fire Department of radiography testing.
- Ensuring daily and nightly radiography compliance with established safety procedures.
- Surveying the restricted area and maintaining documentation on site and available for review at all times.

7. Radiography Safety

- Reviewing and maintaining documentation of radiographer, area exposure levels, and radiation badge assignments.
 - Attending all radiography operations and assisting the radiography contractor in gaining access to all necessary sites (contact with the radiography contractor is maintained by radio during radiography exposures).
-

Radiography Contractor

The radiography contractor's responsibilities include the following:

- Clearing the restricted area within the 2mR/hr boundary line.
 - Securing the 2mR/hr boundary with ropes, signs, and red flashing lights.
 - Surveying the 2mR/hr boundary line.
 - Maintaining documentation of the restricted boundary at the on-site office available for review at all times. Copies must be supplied daily to the Project Manager.
 - Complying with provisions of this document.
 - Complying with all laws governing the use and handling of a radioactive source. Any discrepancies between governing regulations and this document must be immediately brought to the attention of the Project Manager.
 - Identifying high-radiation areas ($\geq 100\text{mR}$) with posted signs.
-

Authorized Personnel

At least one week before the start of radiography operations, all authorized personnel in, or posted around, the perimeter of the radiography testing area must be trained by the radiography project monitor to understand all procedures and requirements written in this document and the project radiography plan. Authorized personnel are:

- Designated SPC
 - Radiography contractor
 - NASA security personnel
 - Project Manager and designees
 - NASA RSO
 - FOW branch personnel monitoring and allowing access to the facility
-

7.3. General Requirements

Establish Parameters	<p>Prior to exposure, the high-radiation and restricted-area (maximum 2mR/hr) perimeters must be calculated, posted with the required warning signs, and roped off. Warning signs and rope must be of the distinctive magenta and yellow radiation warning material. Flashing red warning lights must be displayed at major entry points and in low-light areas.</p>
Conduct Surveys	<p>Surveys must be done the first night of radiography and continue throughout the project each time the source is moved to verify and document the 2mR/hr safe boundary line. Adjustments to the restricted zone are made based on the initial night's survey and subsequent surveys. The Project Manager and NASA representatives support the radiography contractor during these initial surveys. The radiography contractor must keep survey documentation with survey locations and results noted.</p> <p>The Project Manager must enter the initial survey results into the project files and immediately provide copies to the NASA RSO. Note that surveys of the 9x7ft SWT and 11ft TWT have been performed during previous years with 200 Curie sources of Iridium 192. The results of those surveys may be applied in establishing the 2mR/hr line for future efforts involving the Unitary tunnels.</p> <p>During each radiography shift, the radiography contractor to confirm the 2mR/hr safe boundary limit must survey the restricted area. The Project Manager must also perform at least one survey at the beginning of each radiography shift to confirm the 2mR/hr boundary. These surveys are to be graphed on a map that shows the radiography contractor's 2mR/hr line. These survey maps are to be made available for audit by the NASA, Ames RSO at all times. These records become the property of the NASA, Ames Office of Safety at the conclusion of radiography testing.</p>
Secure Buildings	<p>During the period of radiography, any effected Division building must be closed and locked by Division personnel, tagged by the radiography contractor, and kept off limits to personnel. The building must be inspected by NASA security after locking and tagging all doors. Radiography may not begin until NASA security has reported the building clear and initialed the appropriate checklist and all other checklist items have been verified.</p>

Buildings not under FO division cognizance may be in the restricted zone. The Project Manager must notify the Facility Service Manager (FSM). The FSM must notify all personnel that the building is off limits during periods of radiography. These buildings must be closed and locked by NASA security. The buildings must be inspected by NASA security prior to radiography. Radiography will not begin until NASA security has reported that the buildings are clear.

Secure
Closures

Where required by calculations and verified by measurement, roads must be barricaded by NASA security and entry blocked to the restricted zone.

Restrict Area

The restricted area must be cleared of all unauthorized personnel and kept under direct surveillance during exposure operations. The “No Entry Area” will be determined after initial surveys are reviewed and an assessment of current operations is conducted. Surveillance must be provided by the radiography contractor and by NASA security. NASA security guards will be posted at key locations, so direct surveillance of the restricted area can be maintained at all times.

Establish
Communication

Security guards and radiography contractor personnel must be provided with radios on the same frequency to maintain full communication.

Complete
Records

The Project Manager or night monitor assistant must complete the attached preoperation and postoperation checklists each night of radiography. Enter each completed checklist and survey map into the project files at the end of each radiography shift. Enter records of significant events that occur during the radiography shift on the back side of each night’s survey map.

Emergency
Procedures

The following sections describe actions to be taken in the event of an emergency.

Unauthorized
Entry Into the
Restricted Area

Any individual entering the restricted area will be stopped and removed from the area immediately by the Project Manager or designee and the posted NASA security guards. The guards shall notify the Project Manager immediately that an individual has crossed the 2mR/hr line entering the restricted zone. The guards shall remain at the perimeter of the restricted zone and verbally stop the individual in the restricted zone. If the individual does not stop, the guard shall instruct the radiography contractor to secure the source immediately. The Project Manager with the aide of NASA security shall remove the individual from the restricted area. Then the radiography contractor, as instructed by the Project Manager, may proceed with radiography.

The Project Manager or assistant shall record the individual's name, branch affiliation, immediate supervisor, branch chief, time of entry, date of entry, whether individual was aware of testing prior to entry, reason for entry, where entry originated, and individual's destination. All information must be documented in the project files. The area of entry and path taken by the unauthorized individual must be surveyed and documented on the survey map. Inform the individual of the radiography testing and to stay clear of the restricted area. The unauthorized entry shall be brought to the attention of the individual's branch chief or higher authority and the NASA RSO the following work day. The Project Manager prepares and submits an incident report.

Stuck or Loose
Source Outside
Camera

The following procedures are followed when the source either gets stuck outside the radiography camera or becomes loose:

Step	Action
1	The radiography contractor notifies the Project Manager or assistant immediately of problems with securing the source.
2	The NASA RSO or alternate must be immediately notified and all activity at project site must be terminated. Security will maintain boundaries and no outside staff will be allowed into the area without approval of the RSO or alternate.
3	The Project Manager or assistant notifies posted NASA security personnel and the NASA Security Office that additional personnel are needed to monitor the area. The Moffett Fire Department must also be notified that the source is not secured.
4	The radiography contractor requires provisions on site to handle such an occurrence and will implement them immediately.
5	Once the source is secured, posted NASA security personnel, the NASA Security Office, and the Moffett Fire Department must be notified that the source has been secured.
6	The radiography contractor immediately files a written report to the Project Manager or assistant of the incident and the remedy.
7	FO division and support services contractor management, the NASA RSO, and the NASA Office of Safety, Health, and Medical Services must be notified immediately if the incident is of major significance. An incident report must be filed with remedy the same day.

End of Chapter

8. Bloodborne Pathogens

8.1. Description

Purpose	<p>The Wind Tunnel Operations Division personnel shall minimize exposure to bloodborne pathogens during any mishap or accident by avoiding human blood or other potentially infectious materials of human origin. Additionally, Division personnel shall know whom to call for assistance when human blood or body fluids are present in the working environment. This chapter states the basic requirements for protection of employees from the potential hazards of occupational exposure to bloodborne pathogens and addresses the OSHA Bloodborne Pathogen Standard requirements.</p> <hr/>
Scope	<p>This chapter applies to all employees, temporary workers, support contractor personnel, and subcontractor personnel who are under the authority of the Wind Tunnel Operations Division and may be exposed to human blood or other potentially infectious materials of human origin.</p> <hr/>

8.2. Responsibilities

Supervisors	<p>Supervisors' responsibilities include the following:</p> <ul style="list-style-type: none">• Ensure their personnel are aware of the requirements of this chapter.• Coordinate response to any exposure incident in accordance with the guidelines of the Ames Bloodborne Pathogens Protection Plan in the Ames Health and Safety Manual, AHB 1700.1.• Complete the following forms from the appendix of the Plan: Exposure Incident Checklist for Supervisors, the Exposure Incident Description, and the Exposure Incident Evaluation form. <hr/>
Employees	<p>Employee's responsibilities include the following:</p> <ul style="list-style-type: none">• Immediately report any mishap where there is a potential for exposure to bloodborne pathogens.• Minimize risk of exposure to self and others when potential for exposure to bloodborne pathogens exists. <hr/>
Division Safety Office	<p>The Division Safety Office's responsibilities include the following:</p> <ul style="list-style-type: none">• Ensure this chapter is kept current.• Assist supervisors in awareness training of their personnel.• Support mishap-reporting procedures. <hr/>

8.3. General Requirements

Description	<p>Bloodborne pathogens are viruses, bacteria, and other microorganisms that are carried in a person's bloodstream and cause disease. If persons come in contact with blood or bodily fluids infected with a bloodborne pathogen, they may become infected. The most commonly transmitted diseases include hepatitis B virus (HBV), human immunodeficiency virus (HIV), and hepatitis C virus (HCV). An exposure incident is defined as contact of human blood or bodily fluids to non-intact skin such as dermatitis or wound, contact to mucous membranes, or injury by a contaminated object.</p>
Response Procedure	<p>Personnel working within the Wind Tunnel Operations Division are not expected to come into contact with infectious materials such as blood or bodily fluids in the normal working day. Should such an incident arise, or if material suspected of being infectious is discovered, the employee shall not attempt to clean up the material. He or she shall:</p> <ul style="list-style-type: none"> • Call 911 and notify the dispatcher of the presence of potentially infectious materials. • Cordon off the area. • Notify supervisor. • Notify the Division Safety Office. <p>For any emergency involving an injury or illness, immediately call 911 from an Ames site phone. The 911 dispatcher will notify the proper on-call safety personnel to evaluate the situation and arrange cleanup. The Health Unit's role would be caring for individuals exposed to potential bloodborne pathogens. They also can assist employees who have been injured or become ill.</p> <p>Employees who sustain minor injuries that result in small amounts of blood loss shall clean up any residue on tools, equipment, and work surfaces as soon as possible. All cleaning materials contaminated with blood or other body fluids shall be deposited in a labeled "biohazard" bag. Disinfectants and bags can be obtained from the Division Safety Office.</p>
Controls	<p>Personnel can assist in controlling an exposure to bloodborne pathogens by ensuring that a contaminated area is restricted. The universal precaution is to assume that all human blood and bodily fluids are infectious. All other control actions shall be left to designated Emergency Responders who are prepared with specialized training, PPE, and HBV vaccinations.</p>

Sharps	<p>Transmission of bloodborne pathogens could occur from an accidental injury with a sharp object contaminated with infectious material. Examples of such sharp objects, referred to as “sharps”, include needles, broken glass, knives, blades, or any other object which can pierce, puncture, or cut your skin. Any needle or sharp object which may be contaminated with blood or other potentially infectious material, shall be discarded in a puncture proof container, labeled as “Biohazard” and discarded as medical waste via the Division Safety Office.</p> <p>Uncontaminated sharp objects shall be disposed of in a closed container that will prevent others from being injured. The container shall be closable, puncture resistant, and labeled with “Sharps Waste” or “Glass Waste”. Bring your “Sharps” container to the Division Safety Office for disposal. If needed, sharps containers or biohazard bags can be obtained from the Division Safety Office.</p>
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First-Aid Providers	<p>First Aid and CPR training is provided at Ames to volunteers who are interested in responding as “Good Samaritans” in an emergency at home or elsewhere. All personnel who take this First Aid and CPR training must also be trained in bloodborne pathogen control procedures and methods to minimize exposure during any revival attempt.</p>
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8.4. References

Ames and Division Documents	<p>Ames Health and Safety Manual, AHB 1700.1</p> <p>Ames Safety Accountability Program, Bloodborne Pathogens</p>
External Documents	<p>Code of Federal Regulations, 29 CFR 1910.1030</p> <p>California Code of Regulations, Title 8, GISO, § 5193</p>

End of Chapter